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ABSTRACT

Part of a series of instructional packages for use in college level economics courses, the document contains nine microeconomics chapters. Chapter I, "Economic Concepts, Issues, and Tools," discusses scarcity and choice; preferences, resources, exchange, and economic efficiency; marginal analysis and opportunity cost; and different economic systems. Chapters II and III focus on the concept, influences, assumptions and implications of demand and supply, respectively. Individual and market demand, firm supply in the short run and firm and industry supply in the long run are also discussed. Chapter IV presents the market in terms of concept and operation, changes in market equilibrium, and intervention and dynamic adjustments. Chapter V considers marginal equivalency conditions and economic efficiency. Resource allocation, profit maximizing behavior, and the principles of Adam Smith are presented. Chapter VI describes the organization of industries in terms of perfect and imperfect competition, monopolies and economics of scale, and regulation. Chapter VII discusses public goods and externalities in relation to private goods, collective action, and economic efficiency. Chapter VIII, "Income Distribution," deals with marginal productivity, economic rents, trade unions, and economic equity. The final chapter discusses international trade: gains from exchange, the theory of comparative advantage, tariffs and quotas, and exchange rates. Economic principles are supported by concrete examples, charts, and tables. For accompanying tests, answer sheets, and study approaches, see SO 011 934. (KC)

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Economic Evaluation of New Technologies in Higher Education.

N.I.E. Report Phase 1,

Volume 6 of 7

March 1978

THE ESMEE FAIRBAIRN RESEARCH CENTRE, HERIOT-WATT UNIVERSITY, EDINBURGH.

SO 011 936

The Esmée Fairbairn Research Centre, TEFRC, was established in 1970 and grew out of the Economics Education Project which was concerned with analysing how economics was being taught in schools, polytechnics, colleges and universities in the United Kingdom. Since its establishment, the Centre has undertaken several studies in the United Kingdom and United States of America, focussing mainly on efficiency in higher education.

Beginning in 1975, the principal research activity of TEFRC will be evaluating the cost effectiveness of alternative systems of instruction in higher education and assessing the likelihood of their diffusion in different institutional settings.

The Research Centre is part of the Department of Economics at Heriot-Watt University. The Director is Professor Keith G Lumsden.

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TABLE OF CONTENTS

Volume 1: Preface
1.1 Introduction
1.2 Pilot Study
1.3 Research Design
1.4 Participating Institutions

Volume 2: Course Packages

Micro Core Courses

2.1 Conventional Course
2.2 Cases Course

Volume 3: Course Packages (cont'd)

Micro Core Courses (cont'd)

2.3 TIPS Course
2.4 Cases-TIPS Course

Volume 4: Course Packages (cont'd)

Macro Core Courses

2.5 Conventional Course
2.6 Games Course

Volume 5: Course Packages (cont'd)

Macro Core Courses (cont'd)

2.7 TIPS Course

Volume 6: Micro Core Units

1 Economic Concepts, Issues and Tools
2 Demand
3 Supply
4 Price and Output Determination in Markets
5 Marginal Equivalency Conditions and Economic Efficiency
6 The Organisation of Industries
7 Public Goods and Externalities
8 Income Distribution
9 International Trade

Volume 7: Macro Core Units

1 Basic Macroeconomic Concepts
2 A Simple Model of Income and Expenditure Determination
3 Aggregate Demand, Unemployment, and Inflation
4 Using the Expanded Model for Policy Making
5 Investment Expenditure
6 Money and Interest
7 Money, Interest, and Income
8 Aggregate Supply
9 International Macroeconomics

MICRO UNIT 1

ECONOMIC CONCEPTS, ISSUES AND TOOLS

1.1 Scarcity and Choice
1.2 Preferences, Resources, Exchange and Economic Efficiency
1.3 Marginal Analysis and Opportunity Cost
1.4 Different Economic Systems

1.1 Scarcity and Choice

1.1.1 All living creatures have wants which they attempt to satisfy.

Example. The white shark wants food for survival. It attempts to satisfy this want by preying on most creatures which swim in the ocean. Some shark hunters, in turn, kill sharks as a means of livelihood. Others hunt sharks to satisfy their wants - the thrill of a dangerous chase or the mounting of a trophy.

1.1.2 In studying economics we do not question how human wants are determined. Whether human wants are determined by the need to survive, e.g. bread and water, the desire for pleasure, e.g. caviar and champagne, gluttony, e.g. Roman style eating orgies, or by other motives is not a primary concern of an economist.

Example. If we observe a family purchasing a third television set we accept as a fact that the family wants a third television set and is willing to pay the price of that set. In their professional capacity economists do not concern themselves with whether the family should want to buy a third television set.

1.1.3 The study of societies, their wants, their values, their morals, their behaviours, are undertaken by other disciplines, for example sociology and psychology. Economists, in contrast, in their discipline, start from a position in which wants and values are given or accepted and not questioned.

Example. Why a tribal chief wants 100 wives is a problem which may be studied by anthropologists. How many wives a chief can afford or under what conditions a chief would be better off with 97 rather than 100 wives are problems which could lie in the economist's domain.

1.1.4 Wants are not limited to basic subsistence items but include housing, clothing, food, transportation equipment, recreation, art, etc., over and above what is needed to sustain human life.

Example. Many families maintain well stocked refrigerators and freezers since friends may come over to watch Monday night football games and children seem continually to want snacks. The fact that some of the food from the refrigerator may finish up in the garbage does not necessarily imply bad housekeeping, e.g. a family may want to have a variety of food available/

available at all times knowing full well that not all of it will be consumed.

Similarly, if you go back in time in this country, you will find that many large families were raised in houses/apartments consisting of two rooms and a kitchen with an outside toilet. Similar conditions, incidentally, remain true for the majority of families in the world today in less developed countries. For most families in the United States today, houses are much more spacious and convenient and meet more than basic shelter requirements.

1.1.5 While certain individuals in the world today may claim that their wants are fully satisfied, no nation makes such a claim. The prevailing view is that as fast as most people satisfy certain wants, new wants emerge and will always continue to emerge. To the extent that this is true, it can be concluded that human wants are insatiable.

Example. Despite having one of the highest living standards in the world, most American families aspire to even higher living standards, e.g. they may want better health care, a swimming pool, a racing yacht, university education for their children or more vacations.

1.1.6 The more people consume of the goods (e.g. cheese and wine) and the services (e.g. hair cuts and college lectures) they want, the better off they become. Becoming better off is expressed by economists in a variety of ways, such as increasing the level of total satisfaction or total utility or total welfare.

Example. After a hard tennis match on a hot summer day you become better off with a glass of water or better still (?) a can of beer, i.e. your level of welfare or utility rises.

1.1.7 It is not difficult to think of situations in which consuming more of a good in some time period does not make an individual better off but actually makes him worse off, i.e. in which the consumption of additional units of a good decreases total utility.

Example. Forcing someone to eat cheesecake, normally enjoyed, until that person was sick would be a case of more of a good lowering an individual's utility level. For the present we shall assume the statement in 1.1.6 is true, i.e. individuals will consume more of a good only if it increases their utility.

1.1.8/

1.1.8 How fully an individual's or society's wants can be satisfied will be determined by the ability of the individual or nation to provide the items which satisfy their wants.

Example. In prisoner of war camps in Germany in World War II relatively few of the prisoners' wants were satisfied. Many prisoners starved to death and many died from disease because insufficient food and medical supplies were available to satisfy basic needs necessary for survival.

1.1.9 Items which help satisfy human wants may be provided by nature or may require effort on the part of individuals to provide them.

Example. Sunset over the Rockies satisfies some individuals' wants but is provided by nature without individual effort. On certain tropical islands coconuts are provided by nature but require some human effort to harvest and eat. At the other extreme considerable co-ordination of effort on the part of many thousands of individuals is required to produce an automobile or put a satellite around Mars.

1.1.10 The ability of individuals or nations to provide the goods and services which help satisfy wants is limited by the resources under their command.

Example. Most students cannot earn A's in all their subjects because of various limitations, e.g. the amount of time available for study. People in many under-developed countries have low life expectancies because of inadequate supplies of food and medical supplies.

1.1.11 A resource is defined as anything which helps produce the goods and services people want.

Example. The wheat farmer's fields are resources, as are his tractors, fertilizer, seed, etc., all of which are required to produce wheat which people want. Similarly the owner of a professional football team requires resources to produce football games which people pay to attend. These resources include a stadium with lights, team doctors and trainers, administrative staff, and football players, including the reserve quarterback who may sit out the season on the bench. To provide students with a university or college education requires buildings, professors, chalk, textbooks, etc., and a significant input of students' time, another resource.

1.1.12/

1.1.12 The dual existence of insatiable wants and limited resources produces what economists call the fundamental fact of scarcity.

Example. Scarcity would cease to exist only if every want could be fully satisfied. This would mean no resource limitation given these wants. If wants on a South Sea island consisted of dates, coconuts, fish and warm sunshine, and if all of these were available in unlimited quantities without any human effort, scarcity would not exist on the island. No one would work and everything would be free.

1.1.13 Because of scarcity all individuals and nations face the same problem: the allocation of limited resources among the many goods and services people in these nations desire.

Example. A household has to decide how to allocate its income among food, clothing, health services, education, transportation, leisure activities, etc. A nation has to decide how to allocate its labor force, lands, factories and other resources among defense goods and services (e.g. B52s, nuclear submarines, army, navy and airforce personnel), health services (medical schools, hospitals, kidney machines, VD clinics), educational services (kindergarten schools, universities, audiovisual equipment, computers, professors), transportation services (highways, aircraft, automobiles, railways), food and drink (wheat, soya beans, steak, pork, bourbon, beer), etc.

1.1.14 Economics is the study of how individuals and nations use resources under their command to satisfy their wants as fully as possible, i.e. to maximize their satisfaction, their utility or their welfare given their resource constraint.

Example. How a student decides to allocate study time among various subjects, how the C.I.A. and K.G.B. decide to allocate their agents to various pursuits, and how General Motors decides to allocate factory space, machine tools and employees to different types of automobiles, are all part of the study of economics.

1.1.15 Economics, therefore, is concerned with scarcity and choice. Scarcity exists because insufficient resources exist to satisfy all wants fully. The need for choice arises because resources allocated to the satisfaction of one want, by definition, cannot be available to satisfy other wants simultaneously.

Example. A child with only 10c. to spend in the candy store has a resource constraint, i.e. 10c. The child has a choice problem because he/she may want many different types of candy but/

but can only afford one 10c. candy bar. Similarly every hour the President of the United States allocates to dealing with foreign policy is an hour less available for domestic policy, re-election, skiing or growing peanuts.

1.1.16 Every individual and society is continually confronted with scarcity and the need for choice.

Example. A multi-millionaire has only 24 hours in each day to be allocated to various pursuits: sleeping, eating, money making. Dwellers in a non-money-using commune with free access to one field must decide how much space to allocate to growing beans, how much to allocate to corn and how much to leave in grass.

1.1.17 While every individual and nation faces the fundamental problem of scarcity and choice, some specific wants can be satisfied without the need for choice. This is possible only when resources required to produce continuously those goods which satisfy such wants are not scarce. Such goods are known as free goods.

Example. Fresh air in the Scottish Highlands is sufficiently plentiful to satisfy fully local residents' wants for fresh air. Fresh air in the Scottish Highlands is a free good therefore.

1.1.18 The fact that resources such as air, water and sunshine, in aggregate, may be in almost limitless supply does not mean that to particular individuals, regions, or countries, they are free goods, i.e. that they are not part of the fundamental economic problem. These bounties of nature are required at different times, in different locations and in different amounts. Resources may be required to accommodate these time, location and quantity needs and since the use of such resources requires choices to be made, economics is concerned with the allocation of free goods.

Example. In many countries of the world there is a sufficient rainfall to provide for agricultural needs without human effort. In other countries, and in parts of our country, such conditions do not prevail. There, water has to be stored, piped and sprinkled in fields, i.e. it becomes a scarce resource and the human effort and other resources required to place the water in the right place at the right time means that these resources and the water itself are not available for alternative uses. In Europe in 1976 water supplies were so limited that many families were allowed two bucketsful per day - domestic supplies were cut off and families had to go to public taps for their bucketfuls. These families were faced with an allocation problem and as you might suspect many English gardens became barren. The Wimbledon tennis courts became dust bowls and there were a lot of dirty automobiles on the highways.

1.2 Preferences, Resources, Exchange and Economic Efficiency

1.2.1 To satisfy wants as fully as possible, given limited resources, individuals and nations must make choices. The best, or most efficient, choice is that which maximizes utility, i.e. satisfies wants as fully as possible, given the resource constraint.

Example. If you want to have as high a GPA as possible and have 30 hours of study time each week (time constraint), you have to decide how to allocate that study time to different subjects. The allocation (e.g. 8 hours to economics, 12 hours to philosophy, 6 hours to mathematics, and 4 hours to French) which yields the highest GPA is the most efficient allocation. Any alternative allocation which yields a lower GPA is, by definition, inferior and does not constitute the best use of the 30 hours study time.

1.2.2 Since it is not possible to satisfy fully all wants, to achieve the highest level of utility possible from given resources, priorities must be assigned to the potential sets of goods and services which could be made available.

Example. In deciding how to spend the weekly budget a household will choose that bundle or set, from the infinite number of possible sets, of goods and services which will provide the highest possible level of utility. The set chosen compared to all the sets rejected will reflect the preferences of the household.

1.2.3 If a given amount of goods were randomly allocated among a group of individuals it might be possible to increase utility levels without increasing the amount of goods through voluntary exchange.

Example. During World War II prisoners in German prison camps sometimes received Red Cross parcels containing tinned milk, jam, butter, biscuits, bully, chocolate, cigarettes, etc. Each prisoner received an identical package but each prisoner had his own individual preferences. Prisoners who did not smoke but liked chocolate could raise their utility levels by exchanging cigarettes for chocolate with prisoners who smoked but did not like chocolate. Note: both groups could become better off through exchange without any increase in the total amount of chocolate and cigarettes.

1.2.4 By exchanging a good with a low level of utility for a good with a high level of utility an individual can increase his total utility level. Ultimately a point will be reached where all possible exchanges/

exchanges which can increase utility will have been made. Then utility can be increased only if additional goods or resources become available.

Example. Once the prisoners in 1.2.4 had exchanged goods until no two prisoners were willing to make any further exchanges, utility levels would increase only if more food parcels were given out.

1.2.5 **Similarly, international trade in today's world allows nations to increase their level of wellbeing by exchanging goods.**

Example. The United States exports electronic calculators to Scotland and imports Scotch whisky from Scotland. Both countries benefit from the exchange.

1.2.6 **Which set of goods and services, from the feasible sets, an individual or nation chooses will be determined by preferences. The feasible sets will be determined by available resources.**

Example. About 50 years ago the Russian leaders made a momentous decision. To enable Russia to become a great power they stated it was necessary to allocate a large percentage of its resources to the making of more resources, i.e. to the making of factories, machine tools, transportation equipment, etc. This meant allocating fewer resources to the production of food, clothing and shelter. Their choice reflected their preferences. The various options available from which to make this choice were limited by total Russian resources. Had more resources been available Russia could have become a great power without the sacrifice of many thousands of lives caused by insufficient food, clothing and shelter.

Example 2. The average U.S. family with an annual income of $12,000 has many options in terms of food, clothing, housing, recreation, etc. from which to choose. Its choice reflects its preferences. The few families with annual incomes in excess of $1,200,000 have wider choices which include everything the average family can afford but which may also include yachts, jets, European vacations and private education for their children. Again their choices reflect their preferences.

1.2.7 **The greater the amount of resources a nation has the larger and more varied will be the sets of goods and services which can be produced.**

Example. Today Kenya cannot produce the number and variety of automobiles, aircraft and university graduates and all other goods and services that the U.S. can, because Kenya does not have as many resources as the United States.

1.2.8 In addition, the better the production techniques, given an amount of resources, the larger will be the amount of goods and services which can be produced.

> *Example. U.S. agricultural experts have stated that the size of many USSR collective farms is too large for efficient management, and if U.S. management techniques were adopted in Russia total Russian agricultural output could be increased with the same or fewer resources.*

1.2.9 It is in the interest of a nation to use as few resources as possible in the production of any one good. The fewer the resources employed in producing a given amount of a good, the greater will be the resources available for the production of other goods, and, consequently, the more fully wants can be satisfied.

> *Example. In building a bridge over a river there is a minimum amount of steel necessary to ensure that the bridge will not collapse when fully utilised. However, it would be a complete waste of steel to keep adding support structures to that bridge to bear, say, 1000 Sherman tanks if no Sherman tank will ever use it, since the steel has many alternative uses, e.g. another bridge over another river.*

1.2.10 The term engineering or technical efficiency describes a situation in which a given amount of a good is produced using the fewest resources possible. Alternatively, engineering efficiency can be defined as maximum output for a given amount of resources. Note the good in question must be of stated quality; the resources required to produce a low quality item cannot be compared in this situation with the resources required to produce a high quality good.

> *Example. A farmer, with a given field, seed, agricultural equipment, weather and fertilizer, wants to achieve maximum wheat yield from that field. There is an infinite number of ways he can allocate the fertilizer over the field. He could dump it in one corner or in the four corners or spread it thickly over one-third of the field only or he could allocate it evenly over the whole field. The reason he chooses the last named option is because logic and experience suggest that this resource (fertilizer) allocation will yield him the largest crop, i.e. that this will be the best or most efficient allocation of the fertilizer.*

1.2.11 The concept of economic efficiency is more complex than the concept of engineering efficiency. To have an economically efficient allocation/

allocation of resources, not only must the least amount of resources be allocated to the production of each good and service, i.e. engineering efficiency, but the set of goods and services produced must be that set which satisfies wants as fully as possible, i.e. no other feasible sets of goods and services could yield a higher level of welfare.

> *Example. A town could build 100 bridges in a manner which was efficient from an engineering viewpoint, i.e. using the least amount of resources for 100 bridges, but could be allocating resources poorly from an economic efficiency viewpoint. This would be the case if bridges yielded less satisfaction than other goods which could have been produced with the resources used for all or some of the bridges. If building 100 bridges, however, did constitute an economically efficient allocation of resources, e.g. in Venice, it would mean that not only was each bridge constructed in an engineering efficient fashion, but that the alternative goods foregone yielded less satisfaction than the 100 bridges.*

1.3 Marginal Analysis and Opportunity Cost

1.3.1 One possible way to solve problems in which economic efficiency is the goal (see 1.2.11) is to consider the potential welfare from every possible resource allocation and choose that allocation which yields the highest welfare.

Example. The following table shows the points a student will achieve in a 2 hour economics final examination for different allocation of time between objective questions (maximum 35 points) and essay questions (maximum 65 points). In this example the limited resource is 2 hours of examination time, the goal is total points maximization, and the choices are different allocations of time to objective and essay questions.

Objective Questions		*Essay Questions*		*Total Points*
Time Spent	*Points*	*Time Spent*	*Points*	
120	*33*	*0*	*0*	*33*
100	*32*	*20*	*23*	*55*
80	*29*	*40*	*38*	*67*
60	*25*	*60*	*48*	*73*
40	*20*	*80*	*55*	*75*
20	*11*	*100*	*58*	*69*
0	*0*	*120*	*60*	*60*

Total points score is at a maximum when 40 minutes are allocated to objective questions and the remaining 80 minutes allocated to essays. Since no other allocation yields a higher total this is the most efficient use of the two hours time.

1.3.2 The disadvantages of the approach in 1.3.1 are first, it may not be feasible always to consider every possible allocation of resources and, second, the calculations could be very time-consuming.

Example. A student, in deciding how to allocate non-class time in a given week, typically has an infinite variety of choices within a time constraint. The act of trying to record all possible permutations on paper, e.g. 84.3 minutes eating + 169.2 minutes playing tennis + 112.6 minutes studying, etc. v. 83.3 minutes eating + 170.2 minutes playing tennis + 112.6 minutes studying, etc., would require a lifetime.

1.3.3 An alternative way to find the optimal allocation of a limited resource, or resources, is to start with a particular allocation and to determine how total utility or welfare changes as the allocation of the resource changes. If total utility increases because/

because of the change in the allocation, then the change should be made. If there is no change in the allocation which will increase utility, then the optimal allocation already exists.

> *Example. In example 1.3.1 select the allocation 80 minutes on objective questions yielding 29 points and 40 minutes on essay questions yielding 38 points. For the allocation of time to be optimal no change in allocation will increase total points.*
>
> *Consider a marginal decrease in time allocated to objective questions and a corresponding marginal increase in time allocated to essay questions, 20 minutes less allocated to objective questions costs the student 4 points on objective questions but 20 minutes more allocated to essay questions gains the student 10 points on essay questions. The net gain in points (utility) of 6 (10 - 4) is positive, indicating that the change should be made, i.e. 60 minutes objective, 60 minutes essay is a superior allocation to the initial 80 minutes objective, 40 minutes essay, but is 60, 60 optimal? A further incremental change to 40 minutes objective and 80 minutes essay yields a net gain of 2 points, but a further change lowers total points by 6. Thus 40 minutes objective, 80 minutes essay is the optimal allocation of time.*

1.3.4 In starting from an initial resource allocation and making a marginal change in that allocation benefits and costs (gains and losses) occur. The gain from the marginal change is called the marginal benefit. The loss from the change is called the marginal cost.

> *Example. In example 1.3.1 when fewer minutes were allocated to objective questions the marginal cost was the decrease in points on objective questions. When these minutes were allocated to essay questions the marginal benefit was the increase in points on essay questions.*

1.3.5 An action, activity or resource reallocation where marginal benefits exceed marginal costs will, if undertaken, result in an increase in utility or wellbeing.

> *Example. In example 1.3.1 starting with any time allocation other than 40 minutes objective and 80 minutes essay, and changing the time allocation in direction of 40 minutes objective and 80 minutes essay, will be an activity in which marginal benefits will exceed marginal costs and will yield a higher points score.*

1.3.6/

1.3.6 The technique of considering incremental changes in resource allocation and weighing the marginal benefits and marginal costs is known as marginal analysis. Marginal analysis therefore is a useful technique for solving problems involving optimization. Because optimization problems in economics contain constraints (e.g. incomes, time, etc.) they are often called constrained maximization problems. In analyzing such problems marginal analysis is used widely by economists and other decision makers.

Example. An egg farmer whose goal is to maximize profits from his egg farm has an optimization or constrained maximization problem. He can vary, within limits, the amount of food per chicken, the temperature and humidity levels within each building, the size of each chicken cage, etc., and continue to produce eggs. If he were to lower the temperature by 1 degree he might save $30 on heating costs, but if egg production were to fall as a result, by 2000 eggs, each worth 2c. to him, the net loss would be $30 - (2000 x 2c.) = $10. A farmer in making such calculations to achieve the goal of profit maximization is using marginal analysis.

1.3.7 Marginal analysis can be critical in optimal allocation decisions both for an individual and a society. The fact that total benefits from an activity exceed total costs does not imply that an activity should necessarily be undertaken.

Example. A nation in considering an extension of its highway system must decide if the benefits from an additional mile of highway outweigh the costs of the additional highway. Consider the table below:

	Extension of Highway				
	1 mile	*2 miles*	*3 miles*	*4 miles*	*5 miles*
Total Benefit ($m)	*.2*	*.5*	*.9*	*1.2*	*1.3*
Total Cost ($m)	*.1*	*.25*	*.4*	*.6*	*.8*

An engineer has produced the above data on total benefits and total costs of a 1 mile, 2 miles, 3 miles, 4 miles and 5 miles highway extension.

One might conclude that the 5 miles extension should be built because total benefits ($1.3m) exceed total costs ($.8) and this, therefore, must be an efficient way to allocate resources. The marginal approach shows the error in this logic.

For the first mile total and marginal benefits are equal ($.2m) as are total and marginal costs ($.1m). Since marginal benefits exceed marginal costs the first mile should be built.

Consider adding a second mile. Here the marginal benefits are \$.3m (\$.5m - \$.2m) and the corresponding marginal costs \$.15m (\$.25m - \$.1m). Thus the second mile is worth adding. Similar analysis holds for the 3rd and 4th miles. However, for the 5th mile the marginal benefit is \$.1m (\$1.3m - \$1.2m) and the marginal costs \$.2m (\$.8m - \$.6m). Since the marginal cost exceeds the marginal benefit the activity, the building of the 5th mile of highway, should not take place despite the fact that the total benefit of 5 miles of additional highway exceeds the total cost. Only 4 miles of additional motorway should be built.

1.3.8 In determining the best use of resources the alternative goods, or outputs, which could be produced must be considered, i.e. the different opportunities for any resource must be evaluated.

Example. The opportunities to which uncommitted hours of a student's time could be allocated during a week typically are considerable, e.g. jogging, studying, watching TV.

1.3.9 In allocating a resource to any one activity, all alternative uses of that specific resource, by definition, are sacrificed.

Example. A student allocating 2 hours to jogging is giving up 2 hours of TV watching or studying.

1.3.10 The best alternative foregone is the cost of any activity or resource allocation. Economists call the best alternative foregone the opportunity cost of the activity undertaken.

Example. A town in Oregon with adequate natural water supplies has resources to build an additional school or an additional hospital, but not both. It decides to build the school since it concludes that the marginal benefits for a school exceed the marginal benefits for a hospital. The opportunity cost of this school is the hospital, i.e. the best alternative foregone. Note that while the same resources (same amount of money) could be used to build a dam, this is a distinctly inferior alternative to the hospital since the town has an ample water supply. Thus the opportunity cost of the school is not the dam, which would provide too low a cost assessment, but the hospital since it is the best alternative to the school.

Example 2. Note in the table in 1.3.1 when 80 minutes were being allocated to objective questions, the marginal cost of a 20 minute decrease in time allocated to objective questions was 4 points, i.e. 29 - 25. The opportunity cost of these 20 minutes allocated to objective questions, however, was the best alternative/

alternative foregone, i.e. 20 minutes allocated to essay questions worth 10 points.

In this example the opportunity cost of any time allocated to objective questions is the points foregone for essay questions and conversely the opportunity cost of any time allocated to essay questions is the points foregone for objective questions.

1.4 Different Economic Systems

1.4.1 Any nation or society, irrespective of political ideology, has to decide how to allocate the scarce resources under its command to satisfy wants as fully as possible. Thus any nation has to decide, given its resource constraints and within a given time period:

1) what goods and services to produce

2) how those goods and services are to be produced, i.e. the problem of engineering efficiency (1.2.10)

3) how those goods and services are to be distributed among the population.

Example. Each nation or society has to decide what types of educational services to provide for its people. Should it provide more or less elementary education, more or less college education, more or less adult education?

Second, each has to decide how to 'produce' education. Should there be large classes or small classes, should students be taught by professors and teaching assistants 10, 11, 12 ....20 hours per week, should computer assisted instruction, programmed learning, and case studies be used, should colleges remain open 12 months per year, or should universities and colleges be abandoned and lectures given by national television?

Third, each nation has to decide who is to receive the educational services. Should the more intelligent members of society receive more education than the less intelligent or vice versa? Should the poor or the rich receive most of the education or should everyone attend the same number of lectures in selected subjects? Or should education be treated like beer: those who want it should pay for it?

1.4.2 There are three methods of solving each of the three fundamental problems: by tradition, by command, and by markets.

1.4.2.1 The traditional solution:

The set of goods and services to be produced is largely determined by social, religious and/or other customs established over time. Changes in output are caused chiefly by the vagaries of nature.

The methods of production are laid down by social custom and habits developed over time.

The distribution problem is solved according to birth right and other social factors, and it is normally not possible for the individual to alter his well being or position in the social hierarchy through his own efforts.

Example. In feudal times, societies tended to be organized around the Manor House and engaged in little trade with other societies. Customs largely determined what to produce; these customs had their basis in survival needs and much economic activity involved ensuring that adequate supplies were available in the winter months.

How goods and services were produced was determined by assigning specific individuals to tasks. The methods employed did not change much over time. The vagaries of nature, such as plagues and bad weather, produced the most important variations in output.

The distribution of income was determined by the individual's position in society, i.e. whether he was the Lord of the Manor, a member of the Clergy, or one of the various types of workers.

A further example of traditional organization is found in the animal kingdom. The Tundra wolves typically lay claim to a certain territory and hunt caribou. Certain wolves hunt, and within the hunting pack individual wolves perform specific tasks such as herding the prey and killing it. The distribution of the kill is determined by the status of individual wolves; some have first choice, others are detailed to carry meat to the pregnant females, and so on.

1.4.2.2 The command solution:

The set of goods to be produced is determined by an individual or central ruling body. Once the set has been determined it is treated as a target and a plan is drawn up to implement the choice decision. The plan is typically for a five year period.

The methods of production are determined by available information on the engineering efficiency of different resource combinations and different amounts of resources are allocated to each industry. Some allowance is made normally for individuals and managers to adjust the deployment of resources in the interests of increasing output.

The distribution problem is solved by stipulating wage or salary levels for different types of worker and prices of goods and services on the basis of predetermined criteria, e.g. equity.

Example. In communist countries most economic activity is determined by central planning committees. Plans are drawn up on how many units of each good should be produced, and the plan is subject to alteration in the light of experience. Resources are allocated in accordance with the plan and managers are given responsibility for pursuing targets. Most wages, salaries, and prices are set in advance in the overall context of the plan.

1.4.2.3 The market solution:

The set of goods and services is determined by the interaction in the market of consumers who are willing to pay for them and producers who are willing to supply them in response to market prices.

The methods of production are determined by the forces of competition among producers who hire resources to produce different goods and services using the least input of resources, i.e. in a manner which is efficient in the engineering sense.

The distribution problem is resolved by how incomes are determined through markets. Individuals having resources which earn higher returns in resource markets will have higher incomes and consequently be able to buy a larger amount of goods and services than individuals with fewer resources or ones which earn lower returns in resource markets.

Example. Many students allocate part of their incomes to hamburgers and milkshakes. There exist around campuses firms who supply hamburgers and milkshakes using certain resources. Some firms build stalls, buy equipment to cook hamburgers and mix milkshakes, and employ people to serve customers. In turn the money paid by these firms for the resources becomes an income to people supplying these resources. The competition among people wishing to buy hamburgers and milkshakes and the firms which supply them determines the price of hamburgers and milkshakes and also helps determine the returns to the resources employed.

It is the joint interaction of people buying and selling that constitutes the market through which allocation decisions are made. Note that in any market there is competition among buyers as well as sellers; for example, when an object is put up for sale by auction, competition is confined to the buyers.

1.4.3 The following table summarises the characteristics of the three solutions to the economic problem. Each of the three solutions is conceptual and does not necessarily apply in a pure form to real life situations.

Table 1.4.3(1) How the Resource Allocation Problem is Solved

Economic Problems / Solution	WHAT TO PRODUCE Determined by:	HOW TO PRODUCE Determined by:	FOR WHOM TO PRODUCE Determined by:	RESOURCE OWNERSHIP
TRADITIONAL	Custom, tradition, culture, religion, etc.	Convention, existing technology.	Individuals' position in the social system, usually based on birth, family ties, etc.	Private individuals, society, or both.
COMMAND	A central planning organisation, making judgements about individuals' preferences.	A central planning organisation, choosing the resource combination and production technique for each area of activity.	Distribution of individuals' incomes, the levels of which are set by a central planning organisation.	The State
MARKET	Individuals expressing preferences by allocating incomes on desired goods and services, and firms responding by producing such goods and services.	Firms competing with each other to produce goods and services using the least amount of resources, the prices of which are set by market forces.	Distribution of individuals' incomes, the levels of which are set by market forces	Private individuals

1.4.4 All nations use different combinations of the three solutions in resolving the problems of what, how and for whom to produce.

Example. Within U.S. households much economic activity operates under the traditional mode. In many families decisions on consumption are made by the parents. One parent earns income while the other runs the household; a set portion of income is shared among family members to spend as they wish. Under the command mode, the government decides how many Chieftain tanks will be produced, who will produce them, and who will be defended by them, i.e. specific groups or the nation as a whole. Under the market mode, the interplay of buyers and sellers determines how many hamburgers and milkshakes will be produced and, simultaneously, how resource owners will be rewarded.

1.4.5 Societies are classified normally as traditional, command or market, according to the type of solution predominantly used to allocate resources. The concomitant of how resources are allocated is resource ownership. In market economies resources are owned by individuals, in command economies by the state, and in traditional economies by both the state and individuals.

(Market economies are also described as 'capitalist' and 'free enterprise'. In the following the phrase 'market' only is used.)

Example. The U.S. is conventionally classified as a market economy because, first, the prices of most goods and services and resources are determined by market forces, and second, the majority of resources are owned by private individuals. In the U.S. economy the traditional sector is confined almost entirely to organization within the household. There is, however, a significant amount of economic activity accounted for by government; it produces approximately 10% of output, such as education, and buys approximately 20% of output, such as tanks. In addition, it regulates prices, employment conditions, advertising, etc., in many private enterprises. Because of this the U.S. is also described as a mixed free enterprise economy or mixed private enterprise economy.

The United Kingdom and Sweden are also classified as mixed free enterprise economies, although the share of economic activity accounted for, and resources owned by, their governments is significantly higher than in the U.S.

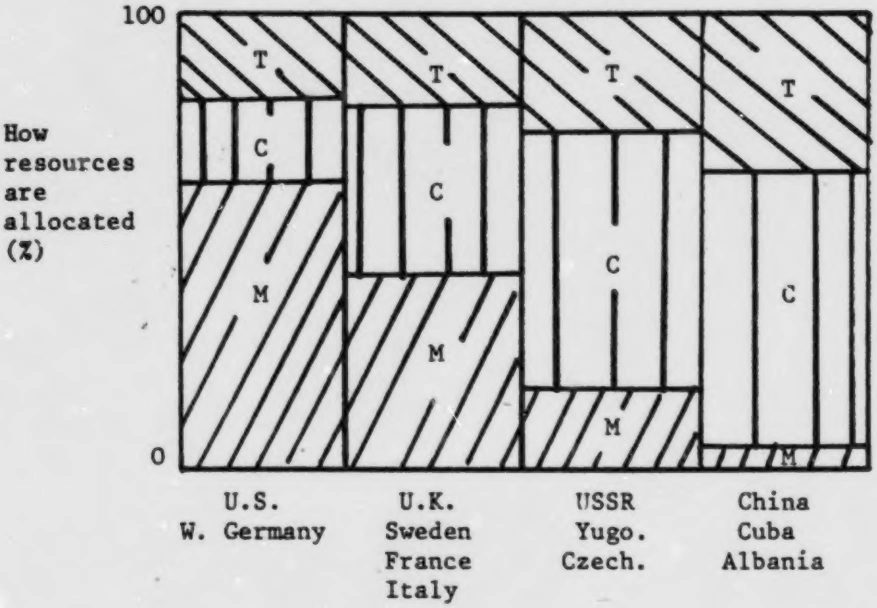
By contrast, government in the USSR largely determines what commodities are produced and most resources are state-owned. Despite the fact that individuals in the USSR have substantial freedom to allocate their incomes on any available goods, and that in the agricultural sector about 30% of output is produced privately/

privately, the USSR is normally classified as a command or centrally-planned economy.

The Peoples' Republic of China is another example of an economy normally classified as a command or centrally-planned system since a group of central planners attempt to set and enforce targets for most agricultural output and production goals for state-owned industries which account for most industrial output. There are also significant elements of a traditional system since about 80% of the population live on agricultural communes and consume mainly the food they produce. Only a few goods are distributed through the market mechanism.

The following diagram gives mixes of different allocative solutions by countries. These mixes are approximate.

Diagram 1.4.5(1) Solutions to the Resource Allocation Problem by Country



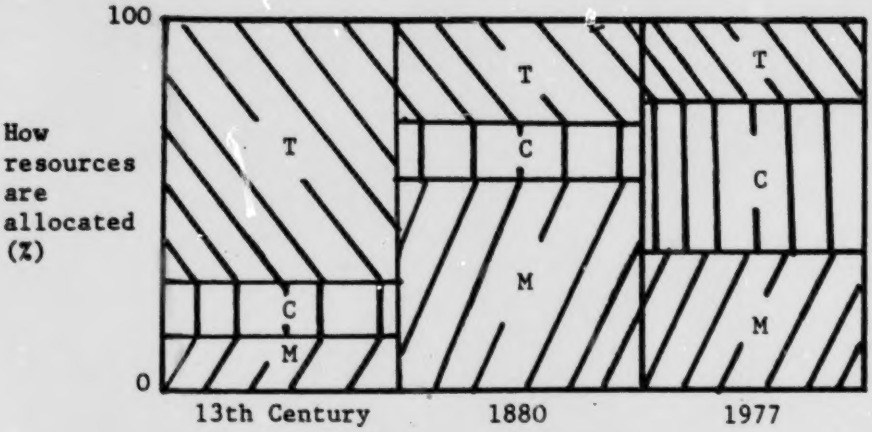
KEY: C = Command T = Traditional M = Market

1.4.6 The classification of a society does not remain fixed. It changes as the solutions to the what, how, and for whom, problems alter in response to developments in the overall economic and/or historical context within which the nation or society exists.

Example. In the 13th century Britain had a traditional type of economic system, as did most European countries. The Industrial Revolution of the 18th century enabled Britain to become the 'workshop of the world' and to emerge as the first and most advanced of the market economies. Since World War II in Britain a larger proportion of allocative decisions have been made though the command mode.

The following diagram shows how the solution to the economic problem in Britain has changed over time.

Diagram 1.4.6(1) The Changing Solution to the Resource Allocation Problem in Britain



Conversely, the past two decades have seen a greater market element appearing in the command economies of Russia, Czechoslovakia, Romania and other Eastern Bloc countries. By and large, the increasing use of markets has been related to the second of the economic problems: how to produce more efficiently.

MICRO UNIT 2

DEMAND

2.1 The Concept of Demand
2.2 Influences on Demand
2.3 Assumptions in the Theory of Demand
2.4 Implications of the Assumptions
2.5 Individual Demand
2.6 Market Demand
2.7 Characteristics of Demand

2.1 The Concept of Demand

2.1.1 Each nation has a finite amount of resources. Therefore there is an upper limit to the amount of goods and services which any nation can produce in a given time period.

However, there is an infinite number of different sets of goods and services which any nation could produce in that time period. To be economically efficient each nation must identify, from all the possible sets of goods and services it could produce, that particular set which would satisfy wants as fully as possible.

Example. One way to express society's wants would be to delegate that responsibility to a young child and let him decide which set of goods and services the economy should produce out of all feasible sets. Since society is a collection of diverse individuals with varied wants, the resulting allocation of resources in favor of the production of candy, milkshakes, cake, ice cream, TV cartoons and comic books would certainly leave most of society believing that resources had been allocated inefficiently. The problem is to find some method to determine the best allocation of resources.

2.1.2 Out of a given income, the amount which an individual is willing to allocate to a particular good is an expression of his want for that good.

Example. In allocating the weekly food budget the typical housewife buys those items which the household wants and does not allocate income to goods which no one in the household wants, i.e. she attempts to satisfy the household's wants as fully as possible given the budget constraint.

2.1.3 The amount of a given income actually spent on a particular good will depend upon the price of that good and its ability to satisfy wants compared to the price of other goods and their ability to satisfy wants.

Example. In allocating the weekly food budget the housewife implicitly uses marginal analysis in a constrained maximization problem (1.3). $10 allocated to steak would yield some utility to the household, $10 allocated to hmaburger would also yield some utility. If only one of these two goods can be purchased because of budget constraint the housewife must evaluate whether $10 would yield more utility if spent on hamburger rather than on steak. Since the/

the price of each will determine what quantities of each could be purchased and consequently how fully wants can be satisfied, price will be a major determinant of how much of each good will be purchased.

2.1.4 A relationship exists between the price of a good and the quantity of that good which an individual would be willing to purchase. This relationship is known as individual demand. The corresponding relationship for the collection of individuals constituting a market is known as market demand.

Example. Each student has an individual demand for textbooks. All students, faculty, administrators, library and computer personnel on a confined campus (a market), have a market demand for textbooks.

2.1.5 The interaction of the demands of individuals for particular goods in attempting to satisfy their wants as fully as possible, and the supply (Unit 3) of goods by manufacturers attempting to gain as much profit as possible, is one of the principal ways in which resources are allocated in a market economy (1.4.2.3). Thus the analysis of demand is of critical importance in understanding how a market operates.

Example. The demand by U.S. citizens for small cars exhibited by the large number of people buying Volkswagens and Toyotas several years ago stimulated U.S. automobile manufacturers to start producing compacts. This involved massive retooling and significant resource reallocation on the part of the three major automobile producers: General Motors, Ford and Chrysler.

2.2 Influences on Individual Demand

2.2.1 A large number of factors influence the amount (including zero) of a particular good which an individual buys. The major factors are:

time period
personal characteristics
values of society
economic factors
expectations.

Example. How much of a specific wine an individual buys will depend upon the time period under consideration, the utility wine affords, which in turn could depend upon whether the individual grew up in a wine drinking household, the attitudes of the society within which the individual lives (e.g. Mormons do not drink wine whereas French children are served wine), the price of local Burgundy versus a French Chateau wine, income constraint, and expectations about future wine prices which will be influenced by the quantity and quality of this year's crop.

2.2.1.1 Time Period: Given an individual buys a specific good the longer the time period under consideration, the larger will be the quantity of that good which an individual will buy, assuming other factors which influence the amount bought do not change.

Example. A beer drinker will buy more beer in a month than in a week, and more in a year than in a month. The fact that he may buy no beer during the week he is in hospital for an appendectomy is not because of the time period under consideration but because his tastes and preferences or some other factors have changed.

2.2.1.2 Personal characteristics: While many people have similar tastes, few, if any, have identical tastes. Precisely how tastes and preferences are determined is unknown, but they are influenced by background and environment, by religion and belief, by temperature and humidity, and by many other factors which bear on the individual.

Example. A bachelor agnostic New Yorker has a different set of tastes and preferences from a devout Mohammedan of the same age living in an extended family on the edge of the desert in Saudi Arabia.

2.2.1.3 Values of society: Most societies have sumptuary laws which are laws prohibiting or limiting the purchase of, or more often the sale/

sale of, various goods and services. In addition, societies often exert moral pressure which can influence individuals. Members of society may break the law or ignore pressure and may suffer explicit (prison) or implicit (exclusion from group activities) penalties.

Example. Bulk purchase and sale of marijuana is illegal in the U.S. and the smoking of marijuana carries different penalties in different States. In certain States, although prostitution is not regarded as a criminal activity, prostitutes are often discriminated against.

2.2.1.4 Economic factors: The economic variables which influence the quantity of a particular good which an individual buys are:

the price of the good
the price of other available goods
the income (budget) of the individual

Example. How much "car" to buy will be influenced by the prices of cars of different sizes and characteristics, the prices of other goods related to running a car, such as gasoline and spare parts, the prices of other goods and services upon which a limited budget may be spent, such as a vacation, and the income available to be spent on all goods.

2.2.1.5 Expectations about the future: Information about possible future events can affect the amount of a particular good which an individual buys in a given time period.

Example. Consider the following newspaper report: "The news for coffee drinkers is not good. Heavy frost in Brazil has severely damaged coffee plants in many areas of the country and experts are predicting one of the poorest crops in several years. Some are predicting that coffee prices could double within a few months, others are even more pessimistic. The reports have sent housewives on a coffee buying spree and several stores have stated that their stocks of vacuum-packed tins of coffee are exhausted."

2.3 Assumptions in the Theory of Demand

2.3.1 A necessary condition for analysing the actions of individuals in buying goods and services is that they act in a manner which is consistent with achieving some objective. If this were not the case, i.e. if the purchases of goods and services by individuals were random, a logical analysis would not be possible.

The assumption made in the theory of demand is that individuals, in allocating incomes on goods and services, attempt to satisfy their wants as fully as possible, i.e. to maximize utility.

> *Example. Typically students do not allocate their incomes by coin tossing. In deciding whether to spend a dollar on a hamburger or a milkshake a student will compare hamburger and milkshake utilities and choose that good which yields the higher utility.*

2.3.2 A number of further assumptions are made in constructing the theory of demand.

2.3.2.1 The individual knows the prices of goods and services in the market. Since the optimal amount of a given income to spend on a particular good will depend on the price of that good and its ability to satisfy wants compared to the prices of other goods and their ability to satisfy wants, a utility maximizing individual must know therefore the prices of all goods and services he might buy.

> *Example. Although a student may gain more utility from a T-bone steak than from a hamburger, his decision on which to buy will be affected by relative prices, as well as relative utilities.*

2.3.2.2 Any unit of a good or service is identical in every respect to any other unit of that good or service, i.e. each good is homogeneous. If goods were not homogeneous, an additional unit of a good would be a new good; hence, more than one unit of the same good could not exist, and a theory of demand would not be possible.

> *Example. One can of Campbell's tomato soup is identical to any other can of Campbell's tomato soup. A can of Heinz tomato soup is a different good.*

2.3.2.3 Each individual has a given income or budget to allocate among goods and services, i.e. he has a known income or budget constraint. To/

To maximize utility in spending a budget, it is necessary to know what quantities of each good and service can be purchased and therefore it is necessary to know what the budget constraint is.

Example. If a student were told that a rich uncle had died and left a legacy, the student would not be able to decide whether to stay on at college, buy a Ferrari, or celebrate with his friends until he found out how much the legacy amounted to.

2.3.2.4 Each individual's demand is considered with reference to a designated time period within which tastes do not change, and within which he must allocate all of his budget.

Example. The answer "three" to the question "How many cans of beer do you drink?", has no meaning without reference to some time period.

2.3.2.5 In order to isolate and measure the impact of changes in one variable on the quantity of a good which an individual wishes to buy, it is necessary to hold constant all other variables which also could affect purchases of that good. Holding constant all variables except one and measuring its impact is an analytical method used by economists. It is often known by its Latin name ceteris paribus (cet.par.) which translates to "with other things remaining equal".

Example. In order to isolate the effect which a change in the price of milkshakes has on individuals' spending on milkshakes, it is necessary to assume that income is constant, that tastes and preferences do not change, that the set of goods and services on which income can be spent is fixed, that the prices of other goods remain the same, and that they are not expected to change in the future. In other words, it is necessary to conceive of a world in which the only factor affecting his demand for milkshakes is a change in the price of milkshakes.

Example 2. In recent years the number of pocket calculators bought by students has increased significantly. Two principal reasons for increased purchases are:

1 the lower prices of calculators
2 the higher incomes of students

To isolate the impact on purchases of the lower prices it would be necessary to hold constant student incomes and other relevant factors affecting purchases of calculators. Similarly, to measure the impact of higher student incomes on calculator purchases/

purchases it would be necessary to hold other things constant, i.e. adopt the cet.par. assumption.

2.3.2.6 The individual is able to identify the satisfaction which he will gain from the consumption of different goods and different amounts of a given good. His satisfaction is expressed in terms of his own measure of utility. For simplicity's sake it is assumed that the individual measures satisfaction in terms of the number of his own "utils" which each unit of a good yields.

Note: In the real world neither can individuals' utilities be compared nor do individuals estimate the number of utils yielded by a good but their choices of goods reflect their own preferences, i.e. they behave as though they were able to assign utilities to different goods in maximizing utility. The precise numbers used in the measurement of utils are themselves unimportant. It is only important that whatever scale of measurement is used enables comparisons to be made of the relative amounts of satisfaction an individual derives from his consumption of different goods.

Example. Faced with the choices of spending an evening at the movies, the theater, a ball game or studying, a student should be able to rank order the choices in terms of the utility each would yield, e.g.

Ball game :	*500 utils*		*50 utils*		*5 utils*
Theater :	*300 utils*		*30 utils*		*3 utils*
Movies :	*200 utils*	*or*	*20 utils*	*or*	*2 utils*
Studying :	*-100 utils*		*-10 utils*		*-1 util*

2.3.2.7 As an individual consumes more of a good in a given time period total utility increases, but at a decreasing rate, i.e. the increase in utility from additional units of a good (marginal utility) falls. This is the principle of diminishing marginal utility.

Note: When total utility reaches a maximum, marginal utility becomes zero and additional units of the good would not increase total utility.

Example. A tennis player at the end of a five set match will obtain more utility from the first mouthful of water than from the second, more from the second than the third, and so on. At some stage, say by the sixth mouthful, he will be sated and will obtain no more utility from additional water. Additional water would not be consumed because it would not add to total utility, i.e. the marginal utility of a seventh or subsequent mouthful of water would be zero, and would be refused/

refused by the tennis player. Table 2.3.2.7(1) presents data illustrating the utility gained by a tennis player from drinking water.

Table 2.3.2.7(1) The Utility from Drinking Water

Number of Mouthfuls of water	Total Utility	Marginal Utility
0	0	
		100
1	100	
		80
2	180	
		60
3	240	
		40
4	280	
		20
5	300	
		10
6	310	
		0
7	310	
		-10
8	300	

2.3.2.8 Total utility can be calculated by summing the relevant marginal utilities.

Example. The total utility from 3 mouthfuls is 240 utils, made up from 100 from the first mouthful, 80 from the second, and 60 from the third.

2.3.2.9 Total utility can be represented diagramatically by plotting total utility against units of a good consumed. If it is assumed that the pattern which emerges between points would also emerge if smaller units were considered, then a consumer's curve can be drawn to exhibit the relationship between utility and units of a good consumed.

Example. Diagrams 2.3.2.9(1) and 2.3.2.9(2) exhibit the plotting of points and the continuous curve showing the relationships of Table 2.3.2.7(1).

Diagram 2.3.2.9(1) The Utility from Drinking Water

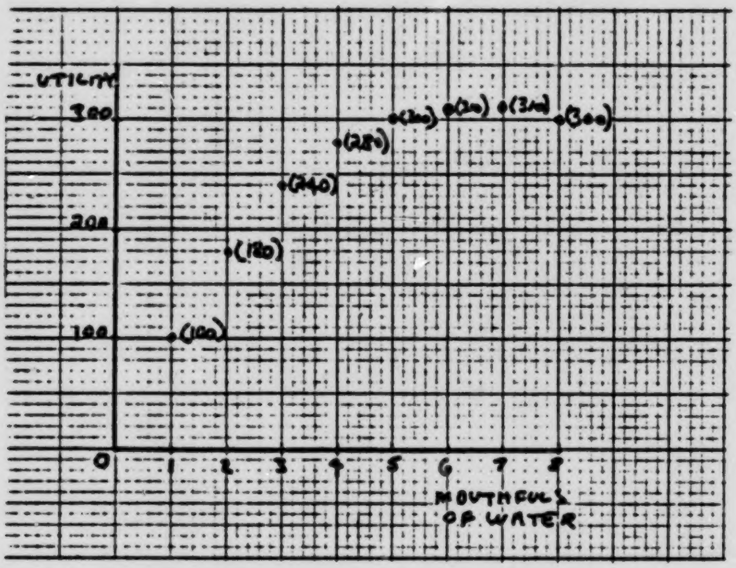
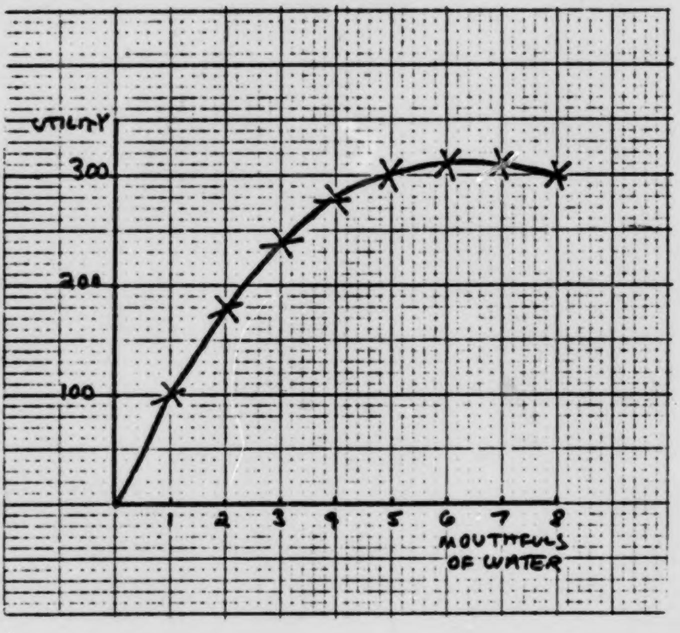


Diagram 2.3.2.9(2) The Utility from Drinking Water



2.4 Implications of the Assumptions

2.4.1 The existence of diminishing marginal utility means that an individual could increase total utility by purchasing a combination of goods rather than by allocating all income to one good. Total utility could be increased by reallocating income from goods with low marginal utility to goods with higher marginal utility.

> *Example. In the cafeteria at lunchtime, students typically do not allocate their lunch budget on coffee alone. The reason is that total utility could be higher by spending the lunch budget on a variety of items, each with a high initial utility. For most people, the first helping of French fries at a price of 20c. would yield more utility than a sixth cup of coffee, the price of which was also 20c.*

2.4.2 Total utility will be maximized when any income reallocation does not increase total utility. This will occur when the last dollar spent on each good yields the same utility, i.e. when

$$\frac{\text{MU of good A}}{\text{Price of good A}} = \frac{\text{MU of good B}}{\text{Price of good B}} = \cdots\cdots = \frac{\text{MU of good Z}}{\text{Price of good Z}}$$

Thus the rule for efficient consumer behaviour, the maximization of utility, is that income must be allocated so that the ratios of marginal utilities to prices for all goods are equal.

> *Example. To explain the above rule in more detail, consider the table below which is constructed under the following assumptions:*
>
> *a) The individual is able to measure his own utility in terms of utils.*
>
> *b) The law of diminishing marginal utility operates.*
>
> *c) The price of the two goods illustrated, hamburgers and milkshakes, is \$1 each. This price is assumed to be unaffected by the behaviour of any individual, i.e. buying or not buying a unit or units.*
>
> *d) The individual has an income of \$10 which he allocates entirely to the two goods in a given time period.*
>
> *e) Hamburgers and milkshakes are the only goods on which he can spend his income.*
>
> *The table shows the total utility gained from consuming up to 10 hamburgers and 10 milkshakes, the marginal utility from each good at each level of consumption, and the total utility gained/*

gained by each possible combination of purchases.

Table 2.4.2(1) Possible Combinations of Hamburgers and Milkshakes from a $10 Income, and Corresponding Utilities

Number of Hamburgers	TU_H	MU_H	Number of Milkshakes	TU_M	MU_M	Total Utility $TU_M + TU_H$
0	0		10	104		104
		13			2	
1	13		9	102		115
		12			3	
2	25		8	99		124
		11			4	
3	36		7	95		131
		10			8	
4	46		6	87		133
		9			10	
5	55		5	77		132
		8			12	
6	63		4	65		128
		4			14	
7	67		3	51		118
		3			15	
8	70		2	36		106
		2			16	
9	72		1	20		92
		1			20	
10	73		0	0		73

Consider the following allocations of the $10 budget:

a) *The individual might decide to divide the $10 equally between the two goods, buying 5 hamburgers and 5 milkshakes, for a total utility of 132 utils, 55 utils from hamburgers and 77 utils from milkshakes. The 55 utils from hamburgers can be calculated by adding 13 utils from the first, 12 from the second, 11 from the third, 10 from the fourth, and 9 from the fifth hamburgers. Similarly, the 77 utils from milkshakes can be calculated by adding 20 utils for the first, 16 for the second, 15 for the third, 14 for the fourth and 12 utils for the fifth milkshake. Since he would derive 9 utils from the 5th hamburger and 12 utils from the 5th milkshake, allocating the budget in this way:*

$$\frac{MU_H}{P_H} < \frac{MU_M}{P_M} \;;\; i.e. \; \frac{MU_H}{P_H} = \frac{9}{1} \text{ and } \frac{MU_M}{P_M} = \frac{12}{1}$$

The individual would gain total utility by increasing his purchases of milkshakes and buying fewer hamburgers. By doing so, he would substitute a good with a higher marginal utility per dollar for a good with a lower marginal utility per dollar.

b) Suppose the individual then reallocates his budget and buys 4 hamburgers and 6 milkshakes instead of the previous combination of 5 hamburgers and 5 milkshakes. He would derive 10 extra utils from the additional milkshake, and sacrifice 9 utils by consuming one less hamburger. Thus his total utility increases from 132 to 133 utils.

With this combination of purchases

$$\frac{MU_H}{P_H} = \frac{10}{1} \text{ and } \frac{MU_M}{P_M} = \frac{10}{1} \text{ so}$$

the ratios of marginal utilities to price in both cases are equal.

c) The individual, however, could not increase total utility by any further reallocation of his budget in favor of more milkshakes and fewer hamburgers. If he were to buy 3 hamburgers and 7 milkshakes, his total utility would fall by 2 since the extra milkshake would provide 8 additional utils while 10 utils would be given up by purchasing one less hamburger. By this budget allocation

$$\frac{MU_H}{P_H} > \frac{MU_M}{P_M} \text{ since } \frac{MU_H}{P_H} = \frac{11}{1} \text{ and } \frac{MU_M}{P_M} = \frac{8}{1}$$

The combination of 4 hamburgers and 6 milkshakes yields the highest total utility because only with these quantities of the two goods will the rule for efficient consumer behaviour be satisfied, i.e.

$$\frac{MU_H}{P_H} = \frac{MU_M}{P_M} .$$

Example 2. Suppose an individual were allocating $10 on beer and peanuts per week, the price of beer being $1.00 per pitcher and the price of peanuts being 25c. per bag. To be in equilibrium the marginal utility of beer would have to be 4 times the marginal utility of peanuts. Suppose the ratio were:

MU/

$$\frac{MU_B}{P_B} = \frac{500}{100} \quad and \quad \frac{MU_P}{P_P} = \frac{150}{25}$$

$$i.e. \quad \frac{MU_B}{P_B} = \frac{5}{1} \quad and \quad \frac{MU_P}{P_P} = \frac{6}{1}$$

By reallocating income from beer to peanuts, total utility will rise since $\frac{MU_P}{P_P} > \frac{MU_B}{P_B}$ *, i.e. the gain in utility from consuming additional peanuts will more than offset the loss in utility from consuming less beer. However, as additional peanuts are consumed* MU_P *will decrease and as less beer is consumed* MU_B *will increase. Utility will be maximized when* $\frac{MU_B}{P_B} = \frac{MU_P}{P_B}$ *when, for example,* $\frac{5.25}{1} = \frac{5.25}{1}$ *or* $\frac{525}{100} = \frac{131.25}{25}$

Note: Because, in the real world, infinitesimally small portions of most goods cannot be purchased, a utility maximizing individual may have to settle for an "equilibrium" position where the ratios are not quite equal but where total utility is at a maximum given the indivisibility of the goods in question.

2.4.3 When the individual is purchasing that combination of goods and services which maximizes his total utility, i.e. where the MU/P ratios for all goods are equal, there is no incentive for him to change his combination of purchases. At this stage he is in equilibrium. Equilibrium is defined as that state where there is an absence of forces leading to change.

Example. In the example of 2.4.2, once the individual has found the combination of hamburgers and milkshakes which maximises his utility, i.e. 4 hamburgers and 6 milkshakes, he would reduce his total utility by changing his purchases. However, if his income were to change, or if the prices of the goods were to change, then he would no longer be maximizing his utility and hence would have an incentive to change his purchases, i.e. he would no longer be in equilibrium.

2.4.4 The analysis developed provides a basis for investigating the behaviour of utility maximizing individuals in response to changes in prices, incomes or other variables.

2.4.4.1 Price Change

Assume that after an individual has reached the utility maximizing income allocation (equilibrium) the price of one good changes. The individual will no longer be able to continue his existing spending pattern and be in equilibrium.

Consider a decrease in the price of one good. The original quantities can still be purchased but this would leave some of the budget unspent. In addition, the price decrease results in the MU/P ratios no longer being equal. To re-establish equality of the ratios (utility maximization) a reallocation of the budget will have to occur.

Consider an increase in the price of one good. The original quantities can no longer be purchased with the existing budget. However, even if the individual were given sufficient additional income to enable him to purchase the initial quantities, he would not maximize utility by doing so because the ratios of MU/P's for all goods would no longer be equal.

> *Example. Assume that the price of milkshakes in 2.4.2 example has increased from \$1 to \$2. This price increase changes the combination of purchases which the individual can make. The new possible purchases are shown in Table 2.4.4.2(1), in which the total utility gained from each possible combination is also shown.*

Table 2.4.4.1(1) Possible Combinations of Hamburgers and Milkshakes from an Income of \$10 after an Increase in the Price of Milkshakes to \$2

Hamburgers	TU_H	MU_H	Milkshakes	TU_M	MU_M	TU_{H+M}
0	0		5	77		77
		13			12	
1	13					
		12				
2	25		4	65		90
		11			14	
3	36					
		10				
4	46		3	51		97
		9			15	
5	55					
		8				
6	63		2	36		99
		4			16	
7	67					
		3				
8	70		1	20		90
		2			20	
9	72					
		1				
10	73		0	0		73

Even if the individual were given an income of $16, which would buy the original combination of 4 hamburgers and 6 milkshakes, the MU/P ratios would not be equal, i.e.

$$\frac{MU_H}{P_H} = \frac{10}{1}, \quad \frac{MU_M}{P_M} = \frac{10}{2} = \frac{5}{1}; \text{ therefore } \frac{MU_H}{P_H} > \frac{MU_M}{P_M}.$$

The individual will reallocate his income until the MU/P ratios are once again equal. This will occur when 6 hamburgers and 2 milkshakes are purchased, i.e. the ratios are 8/1 and 16/2 respectively. In the example the individual now purchases less of the good whose price has increased and more of the good whose price has remained the same.

2.4.4.2 Income change

Assume that after an individual has reached equilibrium his income changes. The individual will no longer be in equilibrium and will have to adjust his purchases to maximize utility. Consider first an increase in income. The sets of possible purchases will increase and to maximize utility the individual must change his purchases until the MU/P ratios are again equal for all goods. Consider now a decrease in income. The sets of possible purchases will decrease, and to maximize utility the individual must change his purchases until the MU/P ratios are again equal.

Example. In the example of 2.4.2 assume that the income of the individual increases to $15, cet.par. This has the effect of changing the possible sets of purchases as shown in Table 2.4.4.2(1).

Table 2.4.4.2(1) Possible Combinations of Hamburgers and Milkshakes from an Income of $15

Hamburgers	TU_H	MU_H	Milkshakes	TU_M	MU_M	TU_{H+M}
5	55		10	104		159
		8			2	
6	63		9	102		165
		4			3	
7	67		8	99		166
		3			4	
8	70		7	95		165
		2			8	
9	72		6	87		159
		1			10	
10	73		5	77		147

It can be seen that when 7 hamburgers and 8 milkshakes are purchased the MU/P ratios are 4/1 in both cases, and the total utility is 166, i.e. at its maximum. The fact that the consumption of milkshakes increased by 2 and hamburgers increased by 3 was due to the pattern of marginal utilities. Note that the marginal utilities of both hamburgers and milkshakes declined due to the fact of diminishing marginal utility. Since the consumption of both goods increased, total utility must have risen. If, as in the Table 2.4.4.2(1), marginal utilities are both positive but declining, marginal utilities and total utility move in different directions.

Note: As income increases in the real world the purchase of all goods does not typically increase in proportion. The reason is that as marginal utilities fall as more of some goods are purchased, new goods are bought to maximize total utility. The purchase of some goods may actually decrease as income increases, e.g. cheap cuts of meat.

2.4.4.3 Changes in other variables

When any variable changes which causes the marginal utility of any good to change, the individual must alter his purchase pattern to maximize utility.

Example. In the example of 2.4.2 assume that the individual student tries out for the football team and that his appetite for hamburgers increases markedly. Table 2.4.4.3(1) shows the new pattern of marginal utilities for hamburgers together with the new amounts of total utility derived from spending his $10 in different ways.

Table 2.4.4.3(1) Possible Combinations of Hamburgers and Milkshakes from an Income of $10 with a New Set of Utilities for Hamburgers

Hamburgers	TU_H	MU_H	Milkshakes	TU_M	MU_M	TU_{H+M}
0	0		10	104		104
		50			2	
1	50		9	102		152
		45			3	
2	95		8	99		194
		40			4	
3	135		7	95		230
		35			8	
4	170		6	87		257
		30			10	
5	200		5	77		277
		20			12	
6	220		4	65		285
		15			14	
7	235		3	51		286
		10			15	
8	245		2	36		281
		5			16	
9	250		1	20		270
		3			20	
10	253		0	0		253

At the original combination of purchases of 4 hamburgers and 6 milkshakes he is no longer maximizing utility. However, increasing the purchase of hamburgers by one and reducing the purchase of milkshakes by one results in a maximum total utility of 286 and brings the MU/P ratios back into equality at 15/1.

2.5 Individual Demand

2.5.1 The quantity of a particular good which an individual purchases depends on a large number of factors.

> *Example. The amount of vacation which a family purchases depends upon the time period under consideration, the price of vacation A versus vacation B versus vacation C, the prices of other goods which could be bought instead of a vacation (a new automobile), the price of goods which are required on vacations (vacation clothes and airline tickets), family income, size and age distribution of family, state of health, weather, etc.*

2.5.2 To isolate and measure the influence of any one factor on potential purchases of a particular good, it is necessary to hold constant all other factors affecting purchases of that good.

> *Example. Suppose that as university fees increase the number of students applying to universities decreases but as family incomes and grants increase the number of applications also increases. To measure the impact of the fee increase alone it would be necessary to hold constant family income and grants.*

2.5.3 In the real world the factors which influence purchases of many goods are constantly changing. In constructing a theory of demand one variable is selected initially, all other factors are assumed to be constant, and the way in which changes in the selected variable would affect purchases of one good are investigated.

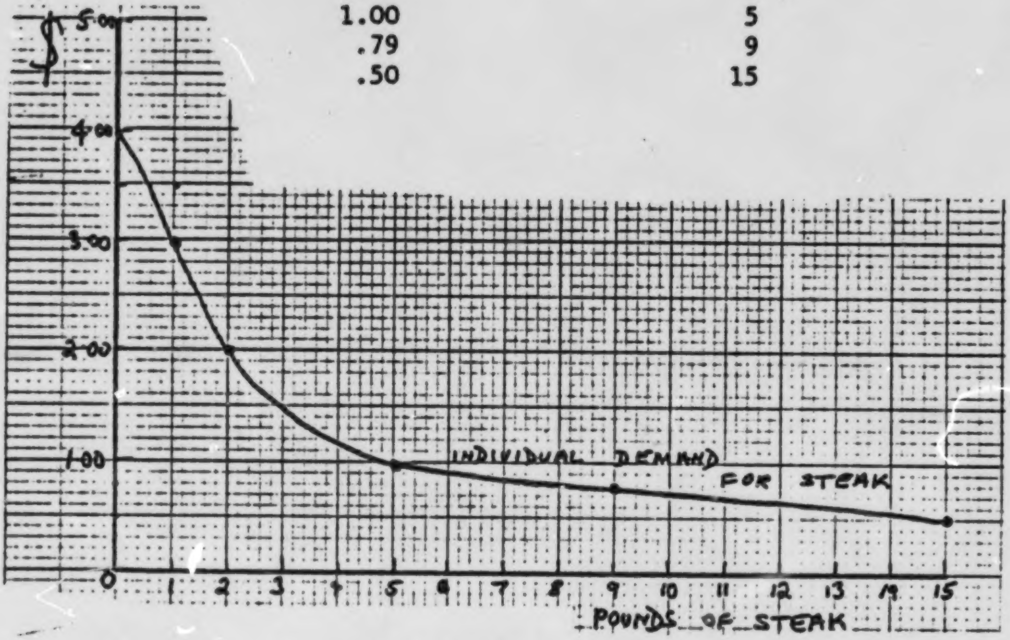
> *Example. In the 2.5.1 example, if the effect of family income only on vacation expenditure were being investigated, ideally families would be selected which were identical in every respect (e.g. tastes, size, age distribution, etc.) except income.*

2.5.4 Because of the importance of prices in providing information to consumers and producers, in economics particular attention is concentrated on the relationship between the price and the amount of a good which an individual would be willing to buy in a given time period, all other factors held constant (cet.par.). This relationship is known as the individual demand for a good.

Example.

Diagram 2.5.4(1) Individual Demand for Steak in a Week

Price ($)	Quantity (pounds)
5.00	0
4.00	0
3.00	1
2.00	2
1.00	5
.79	9
.50	15



This demand curve shows that an individual is prepared to buy less steak at higher prices than at lower prices. specifically, if the price were $2 per pound, the individual would buy 2 pounds; if the price were 79c. per pound, the individual would buy 9 pounds. In this analysis all other factors affecting the amount of steak the individual would be willing to buy are held constant.

2.5.5 A demand curve does not describe an event, i.e. it does not tell what an individual bought. A demand curve is a schedule of intent. It is an hypothetical relationship concerning what an individual would be prepared to buy at each price in a given time period, cet.par.

Example. In moving along the demand curve in 2.5.4, one is comparing what an individual would buy if the the price of steak were $2 compared to what he would buy if the price were 79c. cet.par.

2.5.6 The typical demand curve is negatively inclined to the price axis; at higher prices lower quantities would be purchased and at lower prices higher quantities would be purchased. The reasons for the negative slope are:

1) at higher prices the individual is unable to buy as many units of a good, cet.par., because of the income constraint.

2) at higher prices individuals substitute relatively cheaper goods for the good in question.

Example. If the price of steak were $2 instead of 79c., the individual would not be able to afford to buy as much steak because of his budget constraint. Additionally, other goods such as hamburgers would become relatively more attractive.

2.5.7 The decrease in quantity of a good (good X) that would be purchased at a higher price is, therefore, a combination of two effects; an income effect and a substitution effect.

A higher price of good X will, cet.par., lower an individual's total utility because it decreases the quantities of goods he is able to purchase, i.e. he suffers a loss in real income. An equivalent loss in total utility could be caused by money income (budget) being reduced by a certain amount and prices of all goods, including X, remaining unchanged. Such a reduction in money income would lower the purchase of good X, i.e. the income effect leads to a reduction in the quantity of X purchased.

Alternatively, suppose that the individual's income went up simultaneously with the rise in the price of X. Suppose further that the individual was just as well off after the change as before. He would, of course, buy less X and buy more of other goods and services. The amount of the decrease in X purchased is entirely due to the substitution effect. Therefore, we can say that the substitution effect is the decrease in the quantity of good X purchased that would have resulted from the change in the price of X, with the prices of all other goods remaining the same, if the individual had been compensated for the change in his real income resulting from the change in the price of X.

Example. Consider an individual who chooses to work a 40 hour week at $5 per hour. He does not work any additional hours per week because he considers that each hour of leisure is worth at least $5, i.e. $5, the hourly wage rate, is what he gives up for every hour of leisure he enjoys. If the wage rate were to increase to $10 per hour, would he work more or less than 40 hours per week? The answer depends on the relative strengths of the income and substitution effects.

If he were to continue working 40 hours per week, his weekly income would increase from $200 to $400. At the higher income he will buy more of all goods, including leisure. If he "buys" more leisure it means that he will reduce the number of hours worked per week. Therefore, the income effect would lead to a reduction in hours worked. However, the price of leisure does not remain constant. The cost of an hour of leisure now rises to $10 per hour because that is what it costs the individual to "buy" an hour of leisure. At a higher price for leisure the individual will substitute relatively cheaper goods for leisure, i.e. buy less leisure. But buying less leisure is equivalent to working longer hours. Therefore, the substitution effect would lead to an increase in hours worked. Thus the income effect (buy more leisure) and the substitution effect (buy less leisure) move in opposite directions. It is not possible to know a priori for any given individual which effect will predominate since it will depend upon an individual's preferences for leisure versus income. However, the effect on the average U.S. citizen over time is clear. Hours worked by the average individual in the U.S. have decreased over the past 100 years from over 60 hours to under 40 hours per week, i.e. the income effect has outweighed the substitution effect.

2.5.8 The substitution effect is always negative, i.e. the increase in the price of a good will always lead to the substitution of relatively cheaper goods for that good. The income effect may be positive or negative. For "normal" goods the decrease (increase) in real income, (whether or nor caused by an increase (decrease) in the price of a good) will lead to a smaller (larger) quantity being purchased, i.e. the income effect is positive since changes in real income and quantity purchased are of the same sign. Thus for normal goods the positive income effect reinforces the negative substitution effect and the demand curves for such goods always slope downwards from left to right.

Example. Part of a family's food budget is allocated to chicken, meat and fish. When the price of chicken falls not only will more chicken be purchased because real income will have risen, but more chicken will also be purchased as it is substituted for the now relatively more expensive meat and fish, i.e. the income and substitution effects reinforce each other leading to more chicken being purchased at lower prices and exhibiting the normally sloped demand curve for chicken.

2.5.9 An "inferior good" is one whose quantity purchased falls when real income rises. An increase in real income may be caused by an increase in money income (budget) while the prices of goods remain constant/

constant, or by a decrease in the prices of goods, while income remains constant.

> *Example. As a family's money income rises and the prices of all goods remain the same, the family's real income will also rise. When this occurs, the purchases of cheap cuts of meat usually decline. Other examples of inferior goods are low cost housing since with higher incomes families switch to superior housing, margarine as families substitute butter, dried vegetables as families substitute fresh vegetables, etc.*

2.5.10 For inferior goods the negative substitution effect of a price change generally exceeds the income effect, i.e. the change in the relative price of good X leads to a change in the quantity of good X purchased which is greater than the change in the quantity of good X purchased because of the change in real income caused by the price of X changing. The demand curve is normally sloped.

> *Example. Assume margarine is an inferior good. While a decrease in the price of margarine may lead to a family substituting margarine for butter, the resulting increase in real income may cause more butter and less margarine to be purchased. The substitution effect, i.e. margarine for butter, typically outweighs the income effect which for this good is negative, and which causes less margarine to be purchased because of rising real income. Thus the demand curve for margarine will be normally sloped even though it is an inferior good. A lower price of margarine will be accompanied by a larger quantity purchased, cet.par.*

2.5.11 There is one famous example where the income effect exceeds the substitution effect and where over a range of prices and real income, a non-normal demand curve results. This type of good is known as a Giffen good; at higher prices a larger quantity is purchased, though the range of prices for which this condition holds is limited.

> *Example. In 19th century Ireland the bulk of family income was spent on potatoes, i.e. this was all the people could afford. However, when the potato crop was exceptionally large and the price of potatoes fell a lot, the Irish peasants experienced a significant rise in real income. The same number of potatoes could be bought for much less and with the money left over the Irish families could buy vegetables and meat. However, the purchase of other foodstuffs meant that fewer potatoes were required and thus their purchases could be reduced, i.e. at lower prices fewer potatoes were purchased. This was caused by the very large income effect. However, it is very difficult to imagine any family in the U.S. today for whom/*

whom changes in the price of any one good could have such a dramatic effect on their real income.

2.5.12 The position of the demand curve can be changed by variations in forces which were being held constant. Any such change will alter the amount of a good an individual would be willing to purchase at each price.

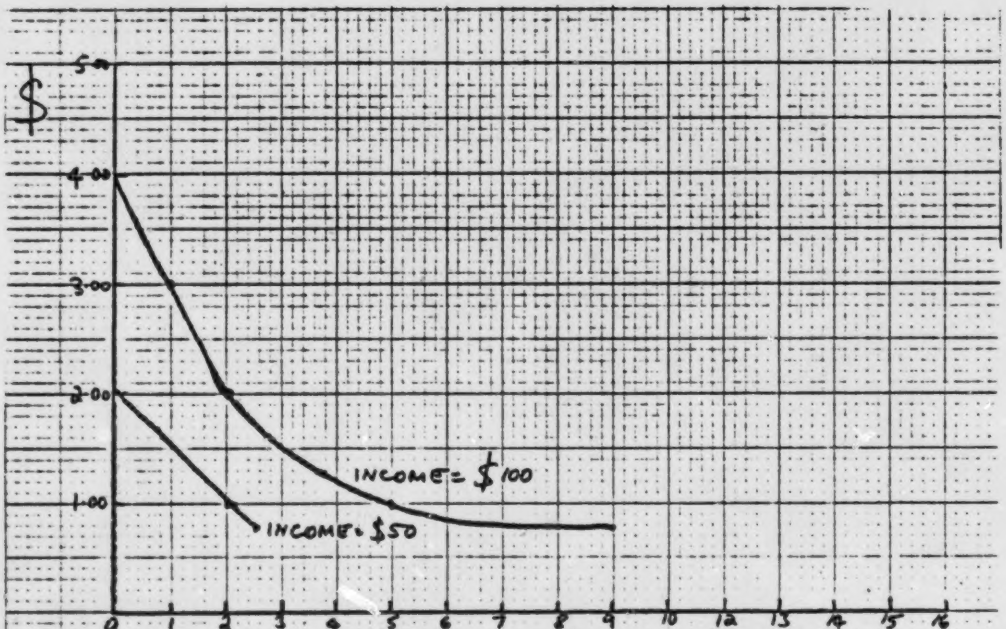
Example. A higher income would affect the amount of steak which the individual would be prepared to buy at each price. In the example of 2.5.4 a decrease in income would affect the amount of steak which an individual would be prepared to buy. Assume the following relationships:

Table 2.5.12(1)

Demand for Steak (Initial Income)			Demand for Steak (Lower Income)		
Price ($)	Quantity (pounds)	Weekly Income ($)	Price ($)	Quantity (pounds)	Weekly Income ($)
5.00	0	100	5.00	0	50
4.00	0	100	4.00	0	50
3.00	1	100	3.00	0	50
2.00	2	100	2.00	0	50
1.00	5	100	1.00	2	50
0.79	9	100	0.79	2.5	50

If income were $100 per week the individual would be willing to buy 9 pounds of steak. However, if income were only $50 per week he would be willing to buy only 2.5 pounds of steak. The following graph shows how the position of the demand curve is different for the two levels of income.

Diagram 2.5.12(1) Demand Curve for Different Levels of Income



Other factors could affect the position of the demand curve for steak, such as large number of guests expected (shift to right), good barbecuing weather (shift to right), illness in the family (shift to left), medical report relating heart disease to consumption of meat (shift to left).

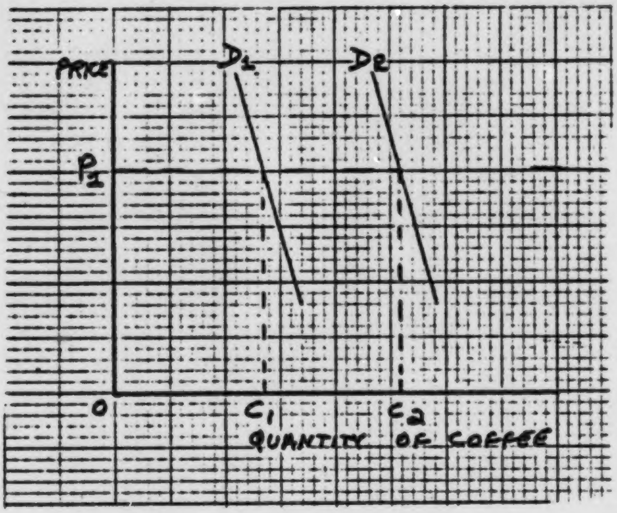
2.5.13 **So far the analysis has been restricted to allocating a given budget or income among a number of goods and services in a given time period. The analysis of demand can be extended to take expectations into account, i.e. analyze behaviour when individuals expect prices and/or incomes to change in the future. Such expectations may affect expenditures during the current period and/or have the effect of causing individuals to shift their income between time periods; i.e. delaying spending now or bringing forward future spending to the present.**

Example 1. An individual during the winter months may not allocate part of his budget to imported strawberries, partly because of their high price, but also partly because he knows the price of strawberries will be much lower during the summer. He thus postpones expenditure on strawberries, though he would be prepared to buy some strawberries all the year round if their prices were constant, even at the imported level, during the year.

(Similarly expectations about future income can affect current expenditure. For example, the ability of students to borrow money and maintain a level of consumption above their current earned income and the willingness of lenders to loan money to students are based on the expectations of both students and lenders that the students' future incomes will be sufficient to pay back the sums borrowed plus interest. The borrowing by students is consistent with utility maximization over a long time period, e.g. a lifetime.)

Example 2. In 1977, supermarkets in the U.S. reported substantial increases in sales of tinned coffee when it was announced in Brazil that sudden frosts had wiped out a significant portion of coffee plants. It was further announced that substantial price increases could be expected. Diagram 2.5.13(1) shows the effect of such price expectations.

Diagram 2.5.13(1) Shifting Demand caused by Expectations



Prior to the announcement from Brazil an individual was buying C_1 *pounds of coffee at a price of* P_1 *on demand curve* D_1. *Expectations of price increases shifted the demand curve to* D_2 *and the purchase of coffee to* C_2.

2.6 Market Demand

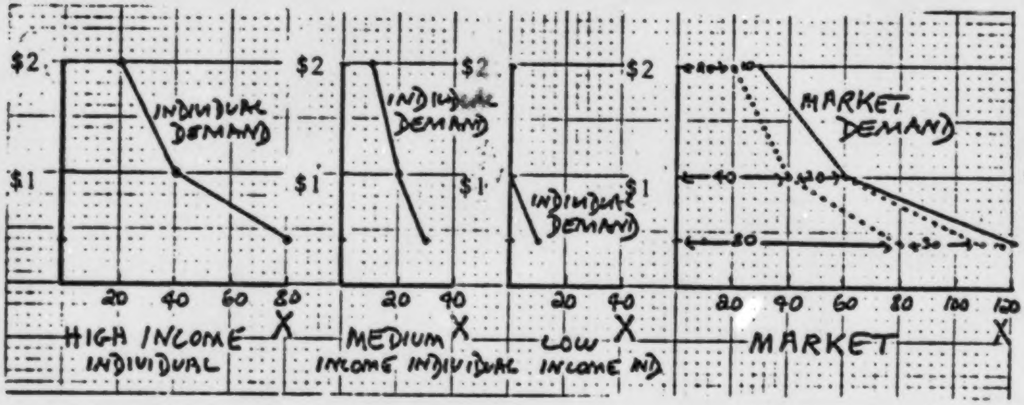
2.6.1 The aggregation of individual demands for a good at different prices in a given time period yields the market demand for that good in that time period. Market demand schedules and market demand curves are therefore constructed from individual demand schedules.

Example. Suppose that the following three individual demand curves exist for Good X in a given time period. Schedules 1, 2, and 2 describe the demands of a high income individual, an average income individual, and a low income individual respectively. Their sum yields the market demand, assuming no other individuals in the market.

Table 2.6.1(1) Individual and Market Demand for Good X

Price ($)	High Income	Medium Income	Low Income	Market Demand
2.00	20	10	0	30
1.00	40	70	0	60
.40	80	30	10	120

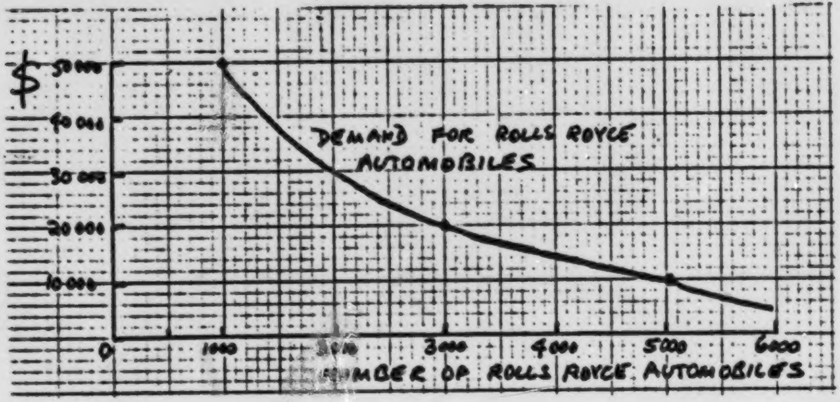
Diagram 2.6.1(1) Individual and Market Demand for Good X



2.6.2 A movement along a market demand curve indicates different quantities of the good that all consumers in that market would be willing to purchase at each price in a given time period, cet.par.

Example. Assume the diagram below shows the U.S. market demand for Rolls Royce automobiles.

Diagram 2.6.2(1) Market Demand for Rolls Royce Automobiles

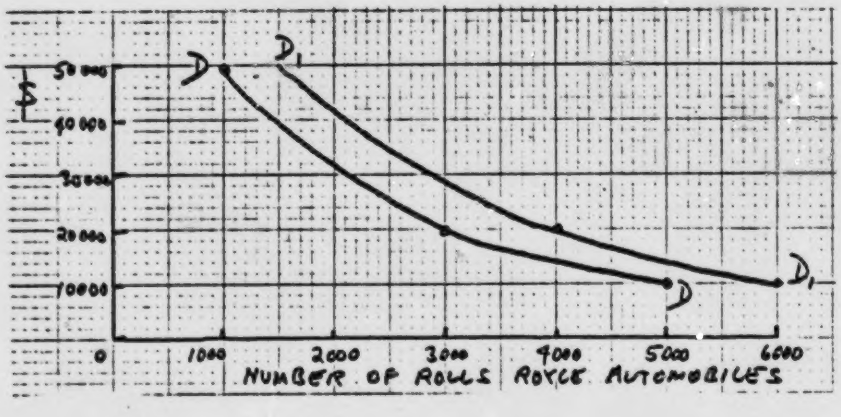


If the price of a Rolls Royce were $50,000, the quantity demanded would be 1,000 per annum. By contrast, people would wish to buy 3,000 Rolls Royces per annum if the price were only $20,000.

2.6.3 Changes in consumers' incomes, tastes, prices of other goods, price expectations or number of buyers will result in a shift in the position of the entire market demand curve. This means that at any given price consumers would buy a different quantity of the good, in comparison to the quantity demand before the relaxation of the cet.par. assumption.

Example 1. Suppose that those U.S. households which typically buy expensive cars experience a significant rise in income. The effect of this income change on the demand for Rolls Royce automobiles is shown by a shift in the position of the demand curve from DD to D_1D_1.

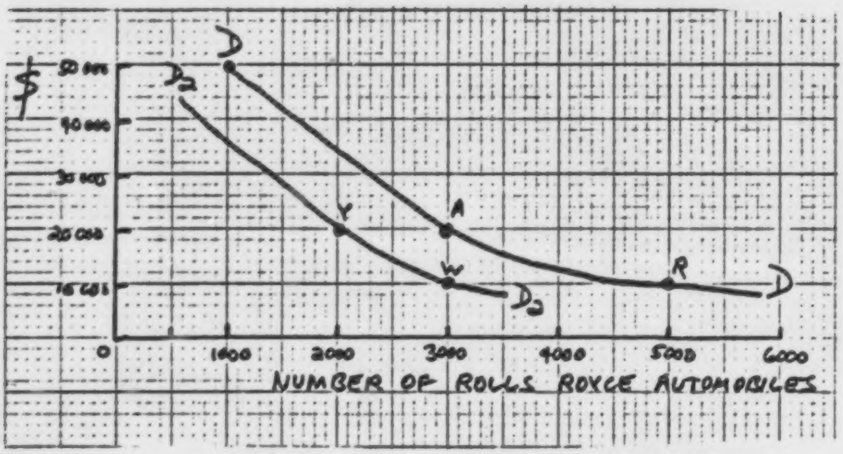
Diagram 2.6.3(1) Market Demands for Rolls Royce Automobiles with Different Income Levels



At the lower income level consumers would be prepared to buy 3,000 Rolls Royce automobiles per annum at a price of $20,000 (point A on demand curve DD). At the higher income level consumers would be prepared to buy 4,000 Rolls Royce automobiles per annum at the same price of $20,000 (point B on demand curve D_1D_1). Similarly, while 5,000 cars per annum would be demanded at a price of $10,000 (point R on demand curve DD), at the higher income level individuals would demand 6,000 cars per annum at the same price (point S on demand curve D_1D_1). The shift of the demand curve from DD to D_1D_1, reflecting the higher income level, is traced out by joining R, S and other points which denote the new quantities which consumers would be prepared to buy at each price.

Example 2. Suppose that a leading Japanese automobile manufacturer produced a new luxury automobile which rivals the Rolls Royce (and which has been named "Wolls Woyce"), but whose price is significantly lower than the price of Rolls Royces. Because some potential buyers of Rolls Royces would now be prepared to buy "Wolls Woyces", the effect would be to shift the demand curve for Rolls Royces from DD to D_2D_2, indicating that consumers would be prepared to buy fewer Rolls Royces at each price.

Diagram 2.6.3(2) Market Demands for Rolls Royce Automobiles with and without the Wolls Woyce



Instead of being willing to buy 3,000 Rolls Royces per month at a price of $20,000 (point A on demand curve DD), only 2,000 per month would be demanded by individuals at that price (point Y on the new demand curve D_2D_2) as a result of the introduction/

introduction of "Wolls Woyces" into the luxury car market. Similarly only 3,000 Rolls Royces per year would be demanded at a price of $10,000 (point W on the new demand curve D_2D_2) compared to 5,000 per month (point R on demand curve DD) before the introduction of the Japanese car.

Points such as Y and W lie on the new demand curve D_2D_2 which shows the reduced quantities of Rolls Royce consumers would be prepared to buy at each price.

Example 3. If the Rolls Royce market within the United Kingdom is compared to the world market for Rolls Royces this would be represented by a shift to the right of the demand curve for Rolls Royces, as potential buyers from the United States, Canada, Saudi Arabia, etc., are added.

2.7 Characteristics of Demand

2.7.1 Typically demand curves slope downwards to the right, indicating that the lower the price of a good the larger will be the quantity of that good individuals will be prepared to buy. However, how much larger the quantity that individuals would buy, for a given price decrease, differs for different goods and also differs for a given good depending upon the point selected on a demand curve.

Example. After the relaxation of price controls on beef in the U.S. in the early '70s the price of beef rose sharply and this led to a significant decrease in beef purchases by U.S. households. Total expenditure on beef fell. In contrast, the large increase in gasoline prices in the same period led to a relatively small decrease in gasoline purchases. Total expenditure on gasoline rose.

2.7.2 The demand for goods can be classified according to the responsiveness of quantity demanded to changes in any of the factors affecting demand. In considering the responsiveness of quantity demanded of a good to changes in the price of that good, all other factors held constant, the classifications are (i) price inelastic, (ii) price elastic, (iii) unitary price elasticity. These classifications imply whether total expenditure on the good would increase, decrease or remain constant as the price of the good changes, cet.par. Similar classifications exist for changes in other factors.

2.7.2.1 Price inelastic. A good is classified as price inelastic when, as price changes, the per cent (proportional) change in the quantity demanded is less than the per cent (proportional) change in price. When the demand for a good is price inelastic, a price increase will lead to an increase in expenditure on the good and a price decrease will lead to a decrease in expenditure on the good, i.e. when $\frac{\Delta Q}{Q} < \frac{\Delta P}{P}$ demand is price inelastic

or, $E = \frac{\Delta Q}{Q} \Big/ \frac{\Delta P}{P} < 1$ demand is price inelastic

(Note: E stands for elasticity, not expenditure)

Total expenditure on the good (P x Q) increases as P increases and decreases as P decreases:

$PQ > (P - \Delta P)(Q + \Delta Q)$

$PQ < (P + \Delta P)(Q - \Delta Q)$

To be mathematically correct, E is normally negative since price and quantity changes move in opposite directions. For convenience, however, it is customary to ignore the minus sign.

Note: In all elasticity discussion it is important to realize that 1) the assumptions under which demand curves were analyzed hold, e.g. given time period, and 2) the concept of elasticity has meaning only for small changes in price, i.e. limited portions of the demand curve can be considered when discussing elasticity.

Example. Consider the following data which refer to the quantity of gasoline demanded by the residents of a town at two different prices during a typical day.

Price ($)	*Quantity (gallons)*
1.00	*100*
1.10	*99*

In considering a price increase from $1.00 to $1.10, the quantity demanded decreases from 100 gallons to 99 gallons, i.e. the demand curve is normally sloped.

$$\frac{\Delta Q}{Q} = \frac{100 - 99}{100} = \frac{1}{100} \qquad \text{and} \qquad \frac{\Delta P}{P} = \frac{1.10 - 1.00}{1.00} = \frac{1}{10}$$

$$E = \frac{\Delta Q}{Q} \Big/ \frac{\Delta P}{P} = \frac{1}{100} \Big/ \frac{1}{10} = \frac{1}{10} < 1$$

i.e. the demand for gasoline over the price range $1.00 - $1.10 is price inelastic.

Simultaneously, a price increase from $1.00 to $1.10 will cause total expenditure on gasoline to increase from $100 ($1.00 x 100) to $108.09 ($1.10 x 99).

Consider a price decrease from $1.10 to $1.00.

$$\frac{\Delta Q}{Q} = \frac{100 - 99}{99} = \frac{1}{99} \qquad \text{and} \qquad \frac{\Delta P}{P} = \frac{1.10 - 1.00}{1.10} = \frac{1}{110}$$

$$E = \frac{\Delta Q}{Q} \Big/ \frac{\Delta P}{P} = \frac{1}{99} \Big/ \frac{1}{110} = \frac{1}{9} < 1$$

i.e. the demand curve for gasoline over the price range $1.00 - $1.10 is price inelastic. (The difference in the values of price elasticity $\frac{1}{10}$ *versus* $\frac{1}{9}$ *is caused by using different bases.)*

In considering total expenditure on gasoline the price decrease will cause total expenditure on gasoline to decrease from $108.09 to $100.

If the owner of the gasoline station were free to set the price of gasoline, price elasticity of demand for gasoline could be an important determinant of the price he sets. The fact that the demand for oil in the world is price inelastic has led to the rapid increase in the revenues flowing to the oil exporting countries since the formation of OPEC and the raising of world oil prices.

2.7.2.2 Price elastic. A good is classified as price elastic when as price changes, the proportional change in the quantity demanded is greater than the proportional change in price. When the demand for a good is price elastic a price increase will lead to a decrease in expenditure on the good and a price decrease will lead to an increase in expenditure on the good.

i.e. when $\frac{\Delta Q}{Q} > \frac{\Delta P}{P}$ demand is price elastic, or $E = \frac{\Delta Q}{Q} \Big/ \frac{\Delta P}{P} > 1$

Total expenditure on the good (P x Q) decreases as P increases and increases as P decreases:

$$PQ < (P + \Delta P)(Q - \Delta Q)$$

$$PQ > (P - \Delta P)(Q + \Delta Q)$$

Example. The following data refer to the quantity of fried turkey demanded by students at Captain Flanders High School in a typical school day.

Price ($)	*Quantity (portions)*
1.00	*100*
1.10	*80*

In considering a price increase from $1.00 to $1.10, the price elasticity of demand of fried turkey is:

$$E = \frac{\Delta Q}{Q} \Big/ \frac{\Delta P}{P} = \frac{100 - 80}{100} \Big/ \frac{1.10 - 1.00}{100} = \frac{2}{10} \Big/ \frac{1}{10} = 2$$

Simultaneously with the price increase total expenditure decreases from $100 to $88.

In considering a price decrease from $1.10 to $1.00

$$E = \frac{\Delta Q}{Q} \Big/ \frac{\Delta P}{P} = \frac{-2}{8} \Big/ \frac{1}{9} = 2.25$$

and total expenditure increases from $88 to $100 as price decreases.

2.7.2.3 Unitary price elasticity. A good is classified as being of unitary price elasticity when, as price changes, the proportional change in the quantity demanded equals the proportional change in price.

Simultaneously, total expenditure on the good remains constant for both price increases and decreases.

In calculating the proportional changes in price and quantity different numerical results will be obtained if the price and quantity before the change are used as a base compared to the price and quantity after the change (see examples 2.7.2.1 and 2.7.2.2).

> *Example. If the price of a pitcher of beer rises from 75c. to $1.00, we consider that to be a 33% increase whereas if the price of a pitcher of beer were to fall from $1.00 to 75c., we would consider that to be a 25% decrease. Thus the calculation of elasticity using the formula would depend upon whether a price decrease or increase were being considered. When demand is highly price elastic or highly price inelastic, and small changes only are being considered, the exact value of elasticity will not change significantly. However, if the price elasticity of demand is approximately unitary considering a price increase or decrease could yield values slightly less than 1 or slightly greater than 1.*

2.7.2.4 One way of resolving the problem of which price and quantity to use in calculating elasticity is to use the average of both prices and the average of both quantities. In calculating the change in price, for example,

$$\frac{\Delta P}{P} \text{ would become } \frac{\Delta P}{(P_1 + P_2)/2} = \frac{P_1 - P_2}{(P_1 + P_2)/2}$$

Similarly

$$\frac{\Delta Q}{Q} \text{ would become } \frac{\Delta Q}{(Q_1 + Q_2)/2} = \frac{Q_1 - Q_2}{(Q_1 + Q_2)/2}$$

and price elasticity of demand

$$E = \frac{\Delta Q}{Q} \Big/ \frac{\Delta P}{P}$$ would become

$$\text{"E"} = \frac{Q_1 - Q_2}{(Q_1 + Q_2)/2} \Bigg/ \frac{P_1 - P_2}{(P_1 + P_2)/2}$$

Example. In the 2.7.2.3 example the change in the price of the pitcher of beer is approximately 29% whether we are considering a price increase or decrease.

That is, $\frac{\Delta P}{(P_1 + P_2)/2} = \frac{P_1 - P_2}{(P_1 + P_2)/2} = \frac{1.00 - 0.75}{1.75/2} = \frac{.25}{.825} = 29\%$

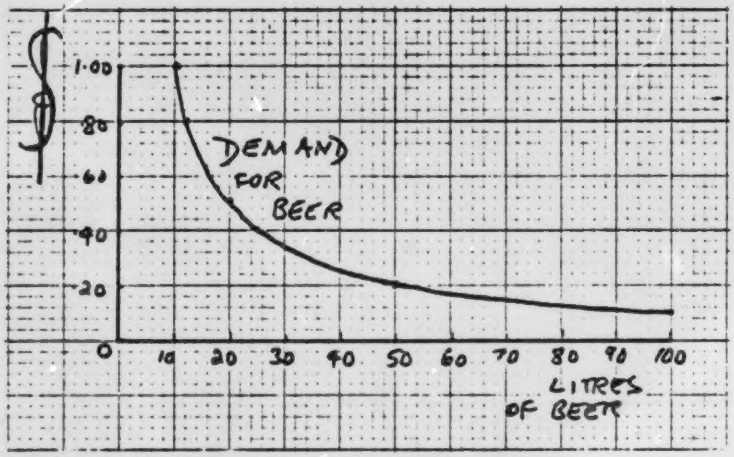
2.7.2.5 By using such a formula it can be shown that if a demand curve is of unitary price elasticity, total expenditure on the good remains constant (2.7.2.3) for both price increases and price decreases.

Example. Consider the following demand schedule and curve for beer.

Table 2.7.2.5(1) Demand and Expenditure Schedules for Beer

Price ($)	Quantity (Pitchers)	Total Expenditure ($)
1.00	10	10.00
.80	12.5	10.00
.50	20.0	10.00
.40	25.0	10.00
.20	50.0	10.00
.10	100.0	10.00

Diagram 2.7.2.5(1) Demand Curve for Beer



In considering a price decrease from $1.00 to $0.80 the increase in the quantity demanded is 2.5 pitchers (12.5 - 10).

Using the formula, price elasticity of demand

$$\text{"E"} = \frac{\dfrac{10 - 12.5}{(10 + 12.5)/2}}{\dfrac{1.00 - 0.80}{(1.00 + 0.80)/2}}$$

$$= \frac{2.5}{22.5} \Big/ \frac{.2}{1.8} \quad \text{(ignoring the negative sign, 2.7.2.1)}$$

$$= \frac{1}{9} \Big/ \frac{1}{9}$$

$$= 1$$

Similarly in considering a price increase from $1.10 to $0.20 the decrease in the quantity demanded is 50 pitchers (100 - 50).

$$\text{"E"} = \frac{\dfrac{100 - 50}{(100 + 50)/2}}{\dfrac{0.20 - 0.10}{(0.20 + 0.10)/2}}$$

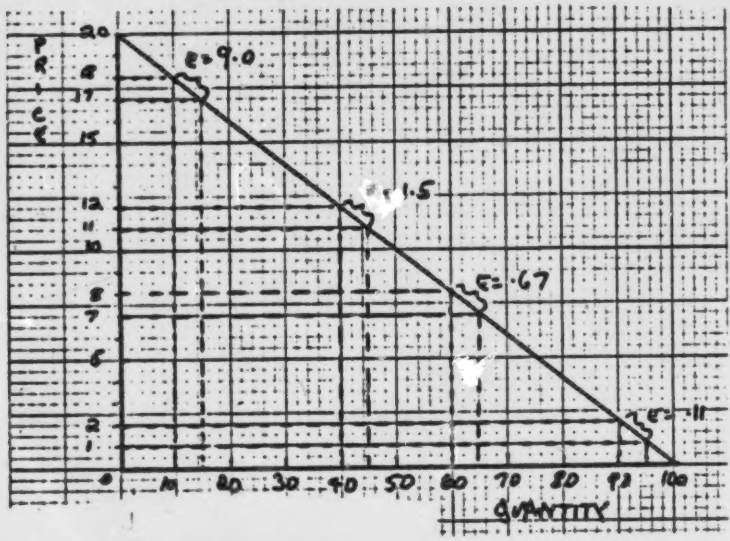
$$= \frac{50}{150} \Big/ \frac{0.1}{0.3}$$

$$= 1$$

2.7.3 Statements about a demand curve being elastic or inelastic refer to limited parts of a demand curve. Price elasticity of demand is not constant throughout the length of a straight line demand curve. At the top of the curve, price elasticity of demand is high (approaching infinity as the curve approaches the price axis), decreases down the length of the curve, passes through unity, and at the lower end of the curve becomes very low (approaching zero as the curve approaches the quantity axis).

Example. The following straight line demand curve shows that when price is 20c. nothing would be purchased and at zero price 100 units would be purchased.

Diagram 2.7.3(1) **Elasticity along a Linear Demand Curve**



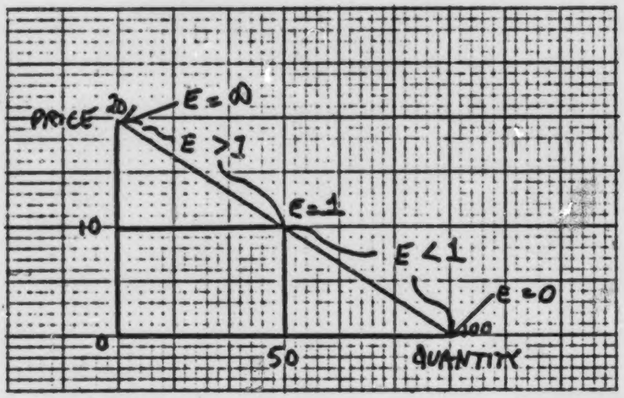
The following table containing calculations of price elasticity of demand shows that the value of E decreases as one moves along a linear demand curve from left to right.

Table 2.7.3(1) **Elasticities along a Linear Demand Curve**

P	ΔP	$\Delta P/P$	Q	ΔQ	$\Delta Q/Q$	$E = \frac{\Delta Q}{Q} \quad \frac{\Delta P}{P}$
18 17	1	1/18	10 15	5	1/2	9
12 11	1	1/12	40 45	5	1/8	1.5
8 7	1	1/8	60 65	5	1/12	.67
2 1	1	1/2	90 95	5	1/18	.11

It is clear that at some point on the demand curve the elasticity of demand is equal ot one. This occurs in the example at p = 10, Q = 50. On a linear demand curve that touches both axes the point of unitary price elasticity of demand is always the mid point of that line. Over the range of the demand curve to the left of the midpoint, E > 1, and approaches ∞ (infinity) as quantity approaches zero. Over the range of the demand curve to the right of the midpoint, E < 1 and approaches zero as P approaches zero. The following diagram shows these points.

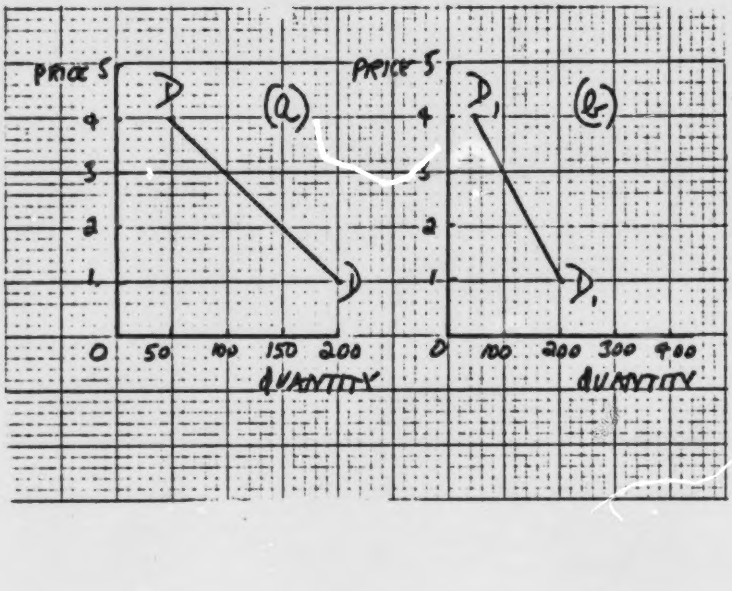
Diagram 2.7.3(2)   Linear Demand Curve



2.7.4 It is misleading to judge the price elasticity of demand for a good by looking purely at the steepness of its demand curve. Everything depends on the scales used on the axes.

Example.

Diagram 2.7.4(1)



In the diagrams above, demand curve D_1D_1 *is steeper than demand curve DD, but it would be wrong to infer that* D_1D_1 *was a more inelastic demand curve than DD. In fact, curves DD and* D_1D_1 *are identical demand curves. Since the steepness of the curves will depend on the units denoted on the axes, and since quantities are measured at 100 unit intervals in Diagram B compared to 50 unit intervals in Diagram A, it follows that* D_1D_1 *will be steeper than DD. But in both cases exactly the same quantities would be demanded at each price.*

2.7.5 Other demand elasticities exist besides price elasticity of demand. A change in the price of one good can affect the quantity of another good demanded. The measure of this responsiveness is known as cross elasticity of demand and it is measured as

$$\frac{\Delta Q_A}{Q_A} \Big/ \frac{\Delta P_B}{P_B}$$

This ratio can vary from plus to minus infinity. Complementary goods have a negative cross elasticity, i.e. an increase in the price of one good will lead to a reduction in the quantity demanded of the complement. Substitute goods have a positive cross elasticity, i.e. an increase in the price of one good leads to an increase in the quantity demanded of the substitute. If the demands for goods are independent of each other the cross elasticity will be zero.

Example. Suppose that the price of butter increased by 10% and it was observed that the demand for bread decreased by 20%. The elasticity is -20/10 = -2, i.e. bread and butter are complements.

2.7.6 As income changes the amount of a good, cet.par., which is demanded may also change. The measure of the responsiveness of quantity of a good demanded to changes in income is:

$$\frac{\Delta Q}{Q} \Big/ \frac{\Delta \text{Income}}{\text{Income}}$$

There are five important values for income elasticity:

Negative - the quantity of the good demanded decreases as income increases

Zero - the quantity of the good demanded does not change as income increases

Between Zero and One - the quantity of the good demanded increases by a smaller proportion than the increase in income

Unitary - the quantity of the good demanded increases in proportion to the increase in income

Greater than One - the quantity of the good demanded increases by a greater proportion than the increase in income

Example. It has been observed that as incomes rise the expenditure on housing tends to rise by a greater proportion, i.e. the income elasticity of demand for housing is greater than one. This means that as people earn higher incomes they tend to spend larger proportions on housing. Goods with negative income elasticity are known as inferior goods, e.g. cheap cuts of meat.

MICRO UNIT 3

SUPPLY

3.1 The Concept of Supply
3.2 Identification of Variables
3.3 Assumptions in the Theory of Supply
3.4 Implications of the Assumptions
3.5 Firm Supply in the Short Run
3.7 Firm Supply in the Long Run
3.8 Industry Supply in the Long Run
3.9 Characeristics of Supply

3. Supply

3.1 The Concept of Supply

3.1.1 In a given time period, because of resource constraints, there is an upper limit to the quantity of goods and services which a society can produce. Within this limit, however, there is an infinite number of sets (different bundles) of goods and services which could be produced.

Example. The U.S. economy has the resources to produce over 50% more output than the USSR economy. A comparison of the two countries shows that proportionately the U.S. allocates more resources to the production of consumer goods and fewer to the production of defense goods than the USSR.

3.1.2 For society to produce the maximum possible amount of goods and services two conditions must be fulfilled. First, for each good produced the minimum amount of resources must be used, i.e. each good must be produced in an engineering efficient manner (1.2). Second, no available resource can be unemployed.

Example. In his famous 'guns and butter' speech of 1965 President Johnson stated that the U.S. economy could substantially increase the production of war materials and the production of consumer goods simultaneously because there were unemployed resources in the economy. In the early '70s, when resource cuts in many universities produced no noticeable decrease in the 'output' of students and/or research, many people argued that this was proof of engineering inefficiency within institutions of higher education.

3.1.3 The fact that all resources are employed in an engineering efficient manner does not guarantee economic efficiency. Economic efficiency also requires that the set of goods and services produced in an engineering efficient manner be that set which maximizes the utility of society (1.2).

Example. A manpower training program in the U.S. may be utilizing the minimum amount of resources required to produce, say, engineers, but this would constitute an inefficient use of resources if additional engineers were not required and hospitals were in need of additional trained nurses.

3.1.4/

3.1.4 When an economy is operating in an economically efficient fashion no redeployment of its resources can increase this society's utility. The only way in which the society can become better off is when additional goods and services become available. This necessitates more resources becoming available and/or better methods of production occurring. In the absence of additional resources or technological change, an increase in the output of one good must result in a decrease in the output of some other good.

Example. A farmer with 200 acres of farmland who is maximizing the amount of wheat which he can produce with his available resources will be able to increase his wheat output only if more resources (i.e. more land) become available to him and/or if superior production methods are discovered. If, on his 200 acres, he decides to produce some corn and there is no change in resources or technology, his output of wheat must fall.

Note: this assumes that extraneous factors which might influence wheat output, e.g. sun, wind, rain, locusts, birds, etc. are unchanged.

3.1.5 This unit analyzes the conditions under which goods and services are produced by firms. Firms are entities (or institutions) which employ resources (factors of production) and by combining the services of these resources produce goods and services.

Example. General Motors is one of the largest firms in the world and employs many resources (land, labor and capital) to produce a large range of automobiles.

A wine waiter produces a service by transferring wine from the cellar to your table and into the appropriate wine glass.

3.1.6 The decisions which society makes concerning how to produce goods and services are implemented in firms. Firms may operate according to conventions, i.e. in a traditional manner; under direction from the state, i.e. in a planned manner; or in response to prices, i.e. under market forces (1.4).

Example. In India many firms exist in the form of small-holdings which are farmed by traditional methods. In Russia firms are provided with directives and quotas which they are expected to meet. In the U.S. firms act in response to prices which they must pay for factors of production and which they obtain for their output.

3.1.7/

3.1.7 In market economies, all firms, whether they are state-owned, under state regulation, or are free to do whatever they wish, subject to legal considerations, must enter the markets for resource services. They must also pay attention to wants, usually expressed by the prices people are prepared to pay for their product.

> *Example. In the U.S. medical services are to a large extent determined by the willingness of the medical profession to supply services at the prices which individuals are willing to pay. In the U.K. most decisions on how much is to be spent on the provision of medical services are made by the government. Medical services are freely available to the population. However, it is still necessary for the U.K. Health Service to buy medical staff in competition with other firms, and although the product is free, i.e. is sold at a zero price, it is necessary for the government to attempt to determine what the needs of the population are in terms of medical care. In the U.S. markets exist for most medical services though some medical services are provided free to the very poor.*

3.1.8 In a market economy a relationship exists between different prices of a good and the corresponding quantities which a firm would be willing to produce, cet.par. This relationship is known as firm supply. The corresponding relationships for the collection of firms constituting a market is market supply, and for all firms constituting an industry, industry supply.

> *Example. At given prices a farmer decides how much land and other resources to allocate to the production of wheat and all other crops. If the price of wheat were to increase and the price of other crops remain unchanged, it would pay the farmer to increase the acres under wheat. This would be true for all farmers. The effect of an increase in the price of wheat would be to increase resources devoted to the growing of wheat and hence increase the total amount of wheat produced.*

3.1.9 The supply of all goods and services in the economy will be limited by resources (factors of production) available in the economy. The following classification is adopted by economists in discussing these factors:

Labor (human resources or human capital)

Capital (man-made resources)

Land (natural resources)

Entrepreneurship

Sometimes labor and entrepreneurship are treated together as "human capital", and capital and land are classified together as "non-human capital".

A feature of developed societies is the growth in quantity and quality of resources over time.

Example. Striking changes in the U.S. in the past 100 years have occurred not only in the range of goods and services produced, but in the way in which they are produced, and the resources available for their production. The vast concentration of resources which currently exists in the automobile industry in Detroit was unknown in 1877, railroads were operated with steam engines, the roads were very poor, farms were just beginning to mechanize and the size of the labor force was small compared to today.

3.1.9.1 Labor: The number of people in the population able and willing to work at going wage rates and working conditions is an economy's labor force. This labor force provides a flow of services which, in cooperation with other factors, produces goods and services. (The determinants of the demand and supply of labor, and other factors of production, are discussed in Unit 6.)

Example. In the past 50 years the population of the U.S. has approximately doubled. Out of a total population of over 210 million persons 43% are in the civilian labor force (93% of whom are employed and 7% of whom are unemployed at this time); 27% are not in the labor force (the bulk of whom are housewives; other groups include the old, retired, sick, and college students). The remaining 30% is composed of persons under the age of 16 and individuals in institutions (e.g. prisons) and in the armed forces.

As the number of people in the labor force has grown the composition has changed. Compared to 50 years ago, fewer older and younger people (earlier retiral and more schooling) and many more women are in the labor force. At the same time the education and skill level has increased. In terms of occupational classification over time the proportion of people working in agriculture and in the manufacturing sector has decreased and the proportion working in services has increased.

3.1.9.2 Capital: This is the stock of non-human resources created in past time periods which is currently available to society. This stock provides a flow of services which in cooperation with other factors of production produces goods and services for society's current consumption, and also new capital for future production.

Example. The quantity of capital in the U.S. has grown over time, but of even greater importance in terms of its contribution to the output of goods and services is the improvement in quality of that capital over time.

For example, to provide education services universities and colleges require a capital stock. This includes lecture theaters, seminar rooms, student dormitories, a computer centre, physics laboratories, roads, sewer pipes, lights, heating units, blackboards, projectors, computers, books, sports pavilions, running tracks and football fields. Over time the number of universities and colleges has increased substantially in the U.S. and much of the quality of the capital stock within them has increased in quality, for example the widespread adoption of calculating machines and the computer.

3.1.9.3 Land: This is the stock of all natural resources including agricultural land. The flow of services from the land, combined with others factors of production, produces goods and services.

Example. Recent disputes have occurred in many countries concerning the 200 mile fishing limit. Countries with coast lines are typically claiming that they own the ocean and its contents up to 200 miles from shore, i.e. it is their resource in the form of "land". This resource, in combination with other factors of production such as boats, fishing nets, and retail shops, produces goods called fish. (Much concern has been expressed by environmentalists about the rate at which sperm whales have been caught in the past and many stocks of this natural resource have been so depleted that they are in danger of extinction.)

3.1.9.4 Entrepreneurship: The existence of stocks of labor, capital and land does not guarantee that they will be put to economically viable use. It is necessary for individuals to identify potential uses for resources, to commit their own personal resources to the organization of other resources, and carry the risk of making a success out of different forms of economic activity. In market economies such activities are carried out by entrepreneurs. In centrally planned economies a group (or groups) of individuals (planners) decide how resources are to be deployed.

Example. U.S. history has many examples of successful entrepreneurs. In the automobile industry Ford and Sloan (General Motors) were entrepreneurs who hired factors of production and produced automobiles which were the cheapest in the world. Today General Motors is one of the largest firms in the world and the value of its output exceeds the value of the total output of many countries in the world. In the USSR automobiles/

automobiles are produced under central planning and individual entrepreneurship to establish new automobile companies in the USSR is not permitted.

3.1.10 The theory of supply is based on the operation of firms in a market economy, and the development of the theory parallels that of demand (Unit 2). The analysis of supply provides the other side of the demand/supply relationship outlined in 2.1.5

3.2 Identification of Variables

3.2.1 Many factors influence the quantity of a good which a firm supplies. The most important of these are:

Time period

Values of society

Economic factors

Expectations

> *Example. The amount of bourbon which a manufacturer produces depends on the length of time considered, the laws which regulate the production of spirits, the willingness of people to work under the conditions which prevail in his distillery, the prices which he will have to pay for the factors of production, and the price for which bourbon can be sold, and expected future prices, which in turn could be affected by the grain crop.*

3.2.2 Time period: the time period within which production takes place must be specified. Within a given time period the manufacturer must decide, in the light of the other factors, how much output to produce, which factors to hire, how much of each to hire, and how to best combine the different factors.

> *Example. It is not informative to state that a manufacturer of bourbon produces 100,000 bottles, without specifying whether this amount is produced in a day, a week, a month or a year.*

3.2.3 Values of society: laws exist which prohibit the production of certain goods and services and/or regulate the conditions under which certain goods and services are produced.

> *Example. It is illegal to distil whisky (or produce nuclear bombs) in your home. Also, in many manufacturing industries children below a certain age can not legally be employed even if they are willing and are capable of doing the job.*

3.2.4 Economic factors: the economic variables which affect the quantity of a good or service which a firm supplies are:

The price of the good or service

The prices of factors of production required to produce that good or service.

The productivity of the factors, i.e. the outputs from different combinations of factors of production.

Together these will determine the profitability of producing a good, which can be compared to the profitability of producing alternative goods. Firms require the information in making decisions concerning which goods to produce and which factors to hire.

> *Example. A shipowner visiting Japanese shipbuilding firms states he is prepared to pay $50m for a 500,000 ton tanker. Each Japanese shipbuilder, in deciding whether to submit an offer to build such a tanker must consider the price of $50m and the costs of the factors required to produce the tanker. Both of these will determine the profitability of the activity; moreover, they must assess the alternatives to tanker building, e.g. building bulk cargo vessels.*

3.2.5 Expectations: information about possible future events can influence the amount which a firm produces in a given time period.

> *Example. A firm may obtain confidential information that the price of its product and the price of the factors of production which it employs are expected to double next year. As a result the firm may decide to employ as many factors as possible and increase its current output and hold stocks until the price changes occur.*

3.3 Assumptions in the Theory of Supply

3.3.1 A necessary condition for analyzing the actions of firms in supplying goods and services is that they act in a manner which is consistent with achieving some objective. If this were not the case, i.e. if firms produced goods and services in a random manner, a logical analysis would be impossible.

The assumption made in the theory of supply is that the goal of the firm is profit maximization. Profits are maximized when the difference between the costs of producing goods and services and the revenues obtained from the sale of goods and services is as large as possible.

Example. In the 1960s the major U.S. automobile manufacturers started to produce compact automobiles when they saw the large and growing import of small foreign automobiles, i.e. the manufacturers responded to the growing demand for small automobiles and reallocated some resources away from large automobiles in the pursuit of the profit maximizing goal.

3.3.2 For pedagogical purposes it will be assumed initially that only two factors of production exist: labor and capital, and that each unit of labor is identical to every other unit of labor and that each unit of capital is identical to every other unit of capital.

Example. The typical bank in a town in the U.S. hires a manager, assistant manager, clerks, typists, security guards, computer operators and cleaners. Because of the specialized nature of the tasks each individual performs in the bank each is considered as a different type of labor by the bank. For the purposes of developing the theory of supply it will be assumed that each bank hires only one type of labor, i.e. that the bank, or any other firm, resembles the farmer hiring migrant workers on a first-come, first-hired basis. In other words the farmer hires the number of migrant workers he needs but does not distinguish one worker from another since all are considered to be identical. The same assumption applies to the use of capital.

3.3.3 In the real world a firm is classified according to ownership of capital employed in the firm. For the purposes of economic analysis the firm can be viewed as the location where resources are combined to produce goods and services under the goal of profit maximization. The ownership of resources, while important to the theory of income distribution (Unit 6) is not relevant to the theory of supply.

Example. The local supermarket may be a cooperative in which many individuals have joint ownership of the supermarket in the sense that they are responsible for the loan on the building and have put up money for inventories of all goods on sale. In contrast, the supermarket in a neighboring town may be owned by one individual or by a collection of individuals who own a chain of supermarkets. For the purposes of studying how goods and services are supplied by supermarkets the ownership of the supermarket is irrelevant.

3.3.4 **The firm is a price taker in both the market for goods and services and the market for the factors of production. The actions of any one firm can not affect significantly the price of the good which it produces and the hiring or non-hiring of any factor of production by a firm will not affect significantly the price of that factor, i.e. a firm can sell all it can produce at the going price and can hire as many units of each factor of production as it wishes at the going price.**

Example. In a large shopping precinct it is not possible for one baker to charge more for bread than other bakers because of the ease with which alternative sources can be found by shoppers. A baker would not charge less for his bread than the going price because he knows he can sell all the bread at that price. Similarly, if the baker were to decide to hire additional shop assistants he could do so without paying more for each additional assistant than he or any other baker pays currently for existing employees.

3.3.5 **While most firms in the real world produce a variety of goods and services it will be assumed that each firm produces only one good and that each unit of that good is indistinguishable from any other unit of that good, i.e. the good is homogeneous.**

Example. Campbells produce a range of soups, and variations exist even within a particular soup. For example, not every can of Scotch Broth contains exactly the same number of peas. In studying the supply of a type of soup the analysis is simplified if each can is assumed to be identical.

3.3.6 For analytical purposes in the theory of supply it is useful to consider a firm in two distinct time periods. (This distinction differs from the need to state the rate at which a firm produces output (3.2.2), i.e. bottles of bourbon produced per hour/day/week/month/year.) The two time periods are defined with reference to the ability of the firm to increase or decrease the quantity of different factors of production which the firm is able to hire or fire. They are not associated with strict time intervals, e.g. hours, days, weeks, months or years.
/

3.3.6.1 When a firm decides to change the rate at which it produces goods, certain factors of production cannot be altered in quantity. The factor whose quantity cannot be altered immediately is known as a fixed factor of production. The factor of production which can be altered and consequently will determine the change in the rate of production is known as the variable factor of production. Normally capital is assumed to be the fixed factor and labor the variable factor.

> *Example. During the War many firms were asked to increase their rate of production of war materials. They were able to do so by hiring more labor and working two or three shifts instead of one, i.e. in some cases a 24 hour day was worked. The number of buildings and the amount of plant and equipment remained unaltered but were combined with more labor to produce more output. In this example labor is the variable factor of production and the buildings and equipment are the fixed factors of production.*

3.3.6.2 The time period during which certain factors of production cannot be altered in terms of quantity hired is known as the short run. The time period during which all factors of production can be varied is known as the long run.

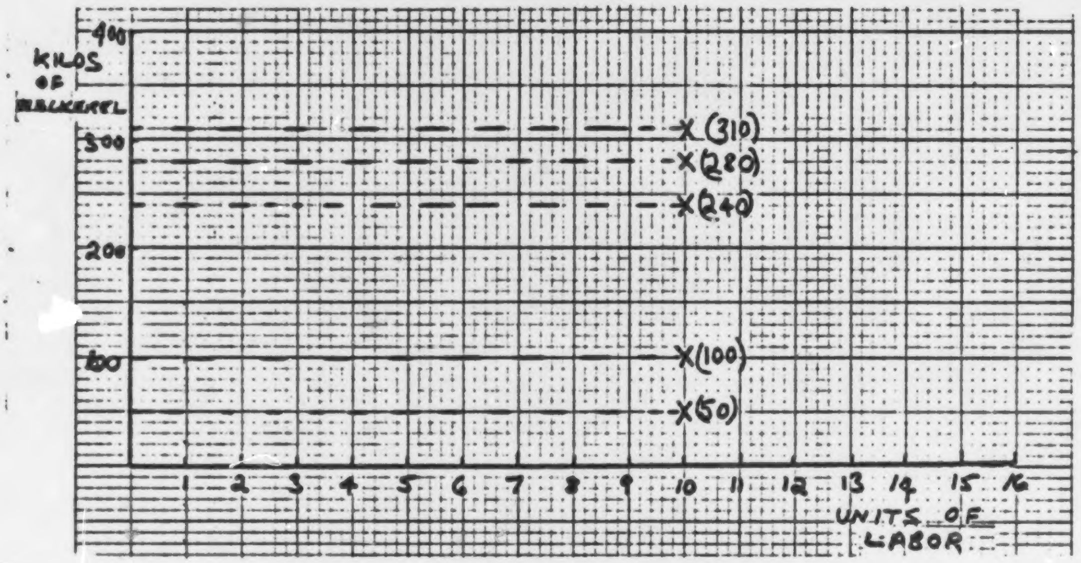
> *Example. If an automobile manufacturer can alter the production of cars in any given week by changing the number of line workers, but if in that week cannot alter the size of factory or assembly lines, plant and equipment, etc., such a period would be a short run period. Conversely, a firm may have an agreement with a union to hire only a given number of workers in a 6 month period, but can alter the number of machine tools within that period. This firm would also be in a short run decision making time period because the amount of labor is fixed.*
>
> *When the firm can vary all factors of production, i.e. increase or decrease labor and increase or decrease all capital inputs, e.g. a firm planning a supermarket when no commitments have been made, the firm is operating in the long run.*

3.4 Implications of the Assumptions

3.4.1 For a given amount of the variable factor of production, in combination with the fixed factor of production, there is a maximum amount of output which can be produced. This will occur when the firm operates in an engineering efficient manner. Also there will be an infinite number of output possibilities where the output is less than the maximum for the given inputs. Each of these outputs is engineering inefficient because it is possible to increase output without an increase in any factor of production.

Example. Imagine the case of a sports fishing boat which, with a crew of 10 comprising both sailors and fishermen, can catch a maximum of 310 kilos of mackerel in one day's fishing.

Diagram 3.4.1(1) Maximum Fish Catch of 10 Crew/Fishermen



The diagram shows that while the maximum output (the catch) is 310 kilos, any amount, such as 280 kilos, is possible. Such outputs less than 310 are engineering inefficient. (It will be assumed that the Captain can always find the shoals of mackerel and that the number of fish caught depends only on the quantity and quality of the factors of production.)

3.4.2 For different amounts of the variable factor of production, combined with the fixed factor of production, there is a maximum set of outputs. The curve which traces these maximum outputs is the production frontier or the productivity curve of the variable factor of production. All points on the production frontier are engineering efficient; all points under the frontier are engineering inefficient.

/

Example. The following data refer to possible mackerel catches on the sports fishing boat of 3.4.1. The fish are caught by rods which are fixed to the side of the boat.

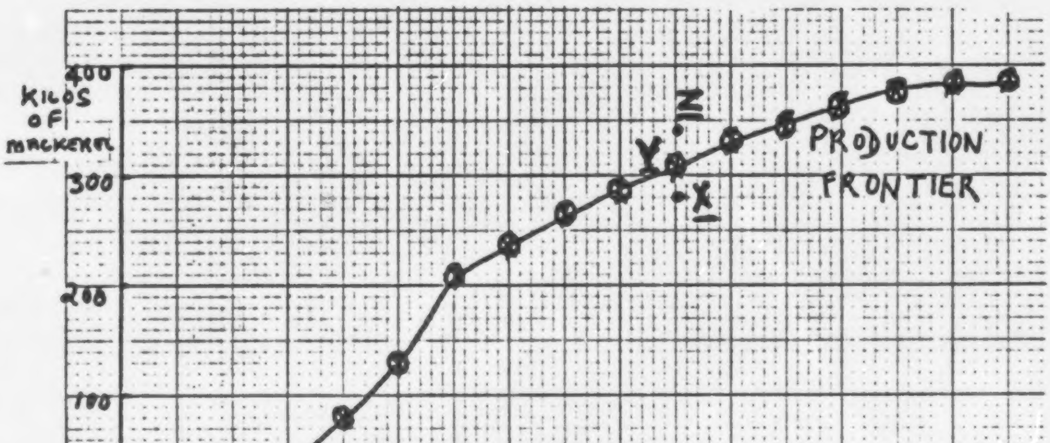
Table 3.4.2(1) Maximum Mackerel Catches possible by varying the Number of Crew/Fishermen

Number of crew	Kilos of Mackerel	Number of crew	Kilos of Mackerel
0	0	9	288
1	1	10	310
2	10	11	330
3	36	12	348
4	80	13	364
5	130	14	378
6	210	15	384
7	238	16	384
8	264		

In a given day, if there is only one man on the boat, the most he can catch is 1 kilo since the bulk of his time is spent piloting the boat. With 2 men on board, i.e. with two man days of labor, more attention can be dovoted to catching fish and the maximum possible input is 10 kilos, though many fish striking the bait are lost because labor is not available to man all the rods. When 15 or more men are on board however, a maximum quantity of fish, 384 kilos, can be caught; in this case all rods are manned and the addition of more crew does not add to the output of fish caught.

The production frontier in Diagram 3.4.2(1) is constructed by joining the points in Table 3.4.2(1). (See 2.3.8 for the construction of diagrams in economics.)

Diagram 3.4.2(1) The Production Frontier for Catching Mackerel



Points such as X (280 kilos with 10 units of labor) lie within the production frontier, i.e. it is possible for 10 men to catch only 280 kilos of mackerel if they do not fish efficiently, or throw fish back. Point Y (310 kilos with 10 units of labor) lies on the production frontier because this is the maximum amount of fish which 10 men can catch in a day. Point Z (340 fish with 10 units of labor) is unattainable and lies outside the production frontier.

3.4.3 The production frontier will shift if the amount of the fixed factor of production changes.

Example. Suppose that in example 3.4.2 the amount of capital (boats, rods, etc.) doubles. With fewer than 11 men the total fish caught will be maximized if 1 boat is used, but with 11 or more men the amount which can be caught will increase.

Table 3.4.3(1) shows the possible catch with 1 boat (i.e. with only one unit of capital) and for two boats (i.e. two units of capital).

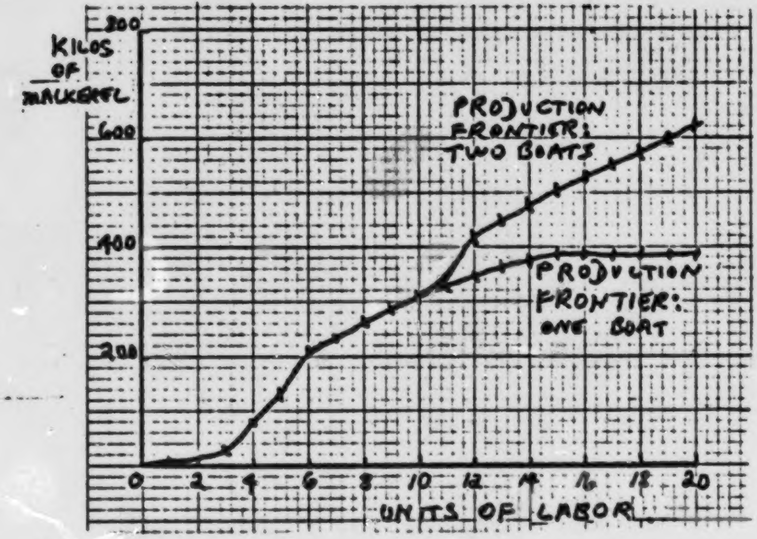
Table 3.4.3(1) Possible Mackerel Catch with 2 Boats

1 Boat		2 Boats		
Number of Crew	Kilos of Mackerel	Boat A No. of Crew	Boat B No. of Crew	Kilos of Mackerel
1	1	1	0	1
2	10	2	0	10
3	36	3	0	36
4	80	4	0	80
5	130	5	0	130
6	210	6	0	210
7	238	7	0	238
8	264	8	0	264
9	288	9	0	288
10	310	10	0	310
11	330	6	5	340(210+130)
12	348	6	6	420(210+210)
13	364	7	6	448(238+210)
14	378	7	7	476(238+238)
15	384	8	7	502(264+238)
16	384	8	8	528(264+264)
17	384	9	8	552(288+264)
18	384	9	9	576(288+288)
19	384	10	9	598(310+288)
20	384	10	10	620(310+310)

For small numbers of men it is not efficient to use both boats. This occurs because if 2 men each took out 1 boat each, they would be able to catch only 2 kilos in total, whereas if they were to go on the same boat they would catch a total of 10 kilos. For 11 or more men more fish can be caught if both boats are employed.

The following diagram shows the production frontier in the two cases.

Diagram 3.4.3(1) **Doubling Capital: a Shift in the Production Frontier**



The production frontier does not differ for up to 10 men; beyond this it is higher for two boats.

3.4.4 The production frontier can change if:

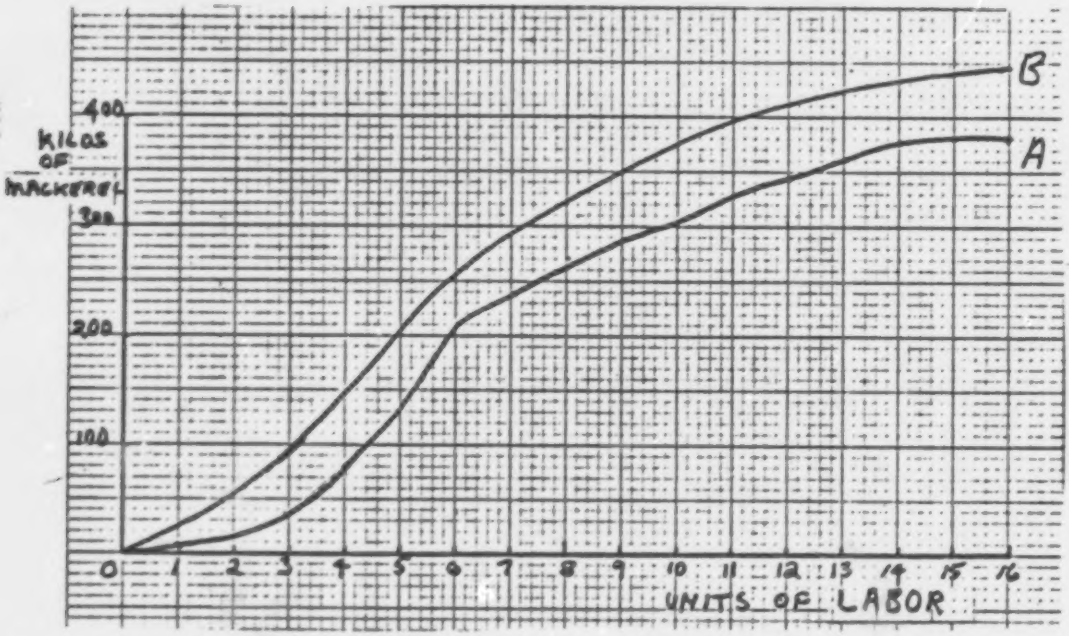
1) better methods are found to combine the variable factor of production with the fixed factor; and/or

2) the quality of the factor of production changes.

(Note that this violates the assumption of 3.3.2, that factors of production are homogeneous.)

Example. The following diagram shows the original production frontier (OA) together with that for a boat fitted with electric spin reels (OB), which enables more fish to be caught at each unit of labor input because of the greater speed with which fish can be landed.

Diagram 3.4.4(1) **A Change in the Production Frontier**



3.4.5 It is generally accepted that the production frontier is not linear, i.e. additional units of the variable factor of production do not produce equal increases in output. The normal assumption is that up to a certain level of output (each unit being produced in an engineering efficient manner) increases in the variable factor of production will yield proportionately greater increases in output, and after a certain level of output increases in the variable factor of production will yield less than proportional increases in output. Ultimately, a level of output will be reached where increases in the variable factor of production will not yield any increase in output.

Example. In example 3.4.2 the addition of a second unit of labor, i.e. an increase of 100%, added 9 units of output, i.e. an increase of 900%. The addition of a 3rd unit of labor (a 50% increase) caused output to rise from 10 to 36 (an increase of 260%).

Up to the addition of the 6th unit of labor the proportionate increase in output exceeds the proportionate increase in labor. From 7 units of labor up to 15 units of labor each additional unit of labor, while causing output to rise, causes it to rise less than proportionately to the increase in labor. A 10% increase in labor (from 10 to 11 units) causes output to increase by 6% (from 310 kilos to 330 kilos). The addition of labor after 15 units were already employed causes no increase in output.

Possible explanations for this phenomenon lie in the scope for the specialization of activities. For example, in employing up to 6 men in the boat, one man pilots the boat, one man nets the fish caught, one man attends to the rods at the bow, another to the rods on the starboard side, and so on. As more units of labor are added each person attends to fewer rods resulting in more fish being caught, but the amount caught by each additional man decreases. When 15 men are on board all rods are manned and associated fishing and piloting functions are fully taken care of. The addition of further units of labor can therefore add nothing to the catch.

3.4.6 A necessary but not sufficient condition for firms to maximize profits is that they produce output in an engineering efficient manner, i.e. they operate on the production frontier. If a firm were producing under the frontier, total output from the factors of production employed would not be a maximum and consequently the costs of producing that output would not be minimized. As a result profit would be less than it otherwise could be.

Example. In example 3.4.2 assume that two identical fishing boats set out each with 10 men on board. Assume that one boat operates on the production frontier and catches 310 kilos of mackerel worth $310. However, the second operates under the production frontier and catches only 280 kilos of mackerel worth $280. Since the boats are identical in terms of the factors employed the costs of producing $310 worth of mackerel on the first boat will be the same as producing $280 worth of mackerel on the second boat. Since the revenues from the catches differ while costs are equal profits will differ.

3.4.7 To analyze supply it is necessary to consider a firm in both the short run and the long run (3.3.6.2), analyze the different amounts and combinations of factor inputs (study of productivity), and the costs associated with each output. First, the productivity of the firm in the short run will be considered and the concepts of total, average and marginal product (output) will be developed. It will be assumed that the firm operates in an engineering efficient manner.

3.4.7.1 Total product is the maximum amount of output which can be produced from different amounts of the variable input in combination with the fixed factor input. The total product schedule is the production frontier (3.4.2).

Example. In diagram 3.4.2(1) the production frontier OPF is the total product, or output, schedule of the mackerel catching firm. In the real world, firms attempt to operate on their production frontiers and hire additional labor when they wish to/

to expand output and fire labor when they contract output. The increase in labor hired by the major U.S. automobile manufacturers in the 60s and the large numbers laid off in the mid 70s result from firms operating on or close to their production frontiers.

3.4.7.2 Average product is calculated by dividing total product by the number of units of variable input. When capital is the fixed factor input and labor is the variable factor input such a calculation will yield the average product of labor, i.e.

$AP_\ell = Q/L$ where AP_ℓ = average product of labor
Q = output
L = units of labor

The average product concept is used by firms in efficiency studies, i.e. in assessing how productive, on average, their labor force is compared to the labor force in other firms.

Example. The average product of labor can be calculated from the output and labor data in Table 3.4.2(1) as follows:

Table 3.4.7.2(1) The Average Catch of Mackerel (Kilos)

N	TP	AP	N	TP	AP
0	0	0	9	288	32
1	1	1	10	310	31
2	10	5	11	330	30
3	36	12	12	348	29
4	80	20	13	364	28
5	130	26	14	378	27
6	210	35	15	384	25.6
7	238	34	16	384	24
8	264	33			

When 4 men are hired on the fishing boat a catch of 80 kilos of mackerel results; the average product of labor is 20 (80/4) kilos of mackerel. Average product of labor increases as labor increases until a maximum is reached when 6 men are hired. Thereafter it declines. The pattern of average product of labor is plotted below, and this is typical of most production situations.

Diagram/

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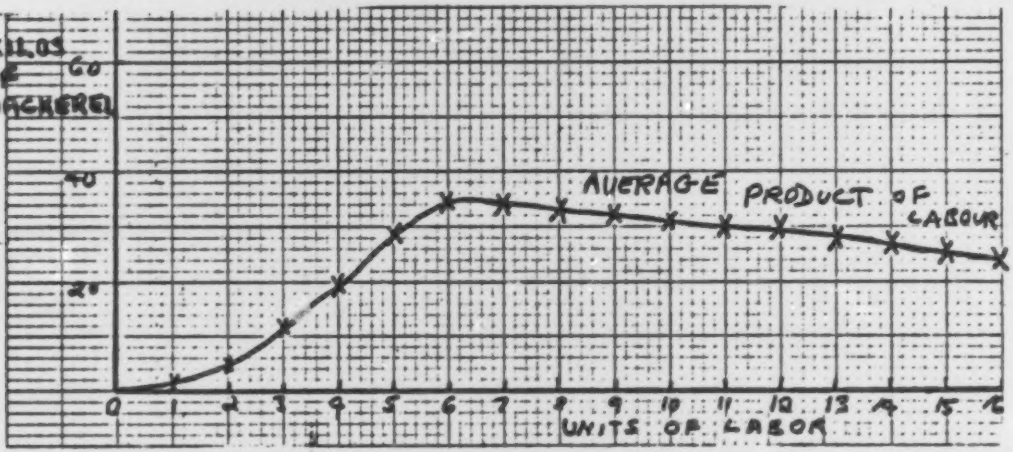
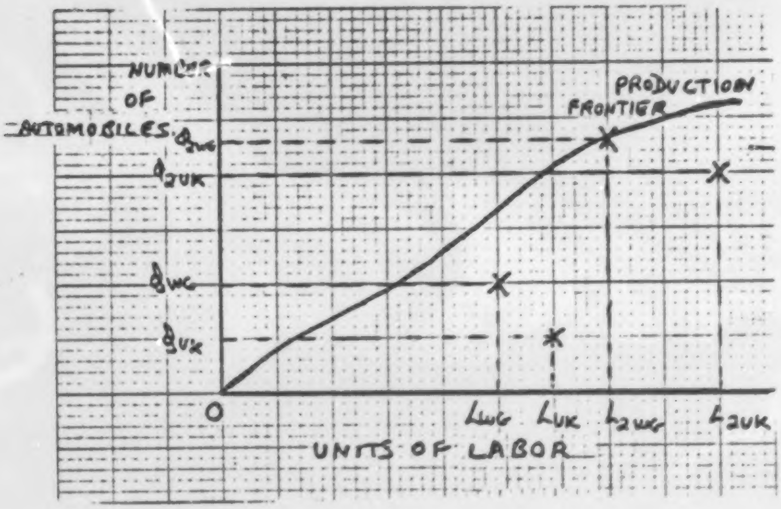
Diagram 3.4.7.2(1) The Average Product of Labor in Catching Kilos of Mackerel



Example 2. The practical significance of the concept of the average product of labor can be shown by the use to which it was put by Mr. Ford, President of the Ford Motor Company, in assessing the firm's European operations. A comparison of the average product of labor in the Ford plant in the U.K. and West Germany showed that the AP_L in the U.K. was significantly lower than the AP_L in West Germany. The difference could not be accounted for by any difference in the amount of fixed factor of production, i.e. capital, nor by the U.K. and West German plants operating at different points on the production frontier since the U.K. operation was employing more men and producing fewer automobiles than the West German counterpart. These facts do not guarantee that the West German plant was on the production frontier but they do guarantee that the U.K. plant was not. Diagram 3.4.7.2(2) shows possible alternatives explaining Mr. Ford's concern.

Diagram 3.4.7.2(2) The Production Frontier for Automobiles



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Note: Many textbooks erroneously have the total product curve turn down, e.g. to pass through the point L_{2uk}, Q_{2uk}. Since the production frontier traces only maximum possible quantities of output from different amounts of labor, point L_{2uk}, Q_{2uk} must lie within the frontier. The argument that additional units of labor "get in the way" of other workers causing total output to decrease implies that space is limited, and consequently space would become a factor of production.

3.4.7.3 Marginal product of a factor is the change in output attributable to a change in the quantity of that factor hired at a given level of employment of that factor. The concept has meaning in considering only small changes in the amount of the variable factor. The general formula for marginal product of a variable factor is

$$MP_{VF} = \frac{Q}{VF}$$

In 1.3 the importance of marginal analysis in problems involving maximization was shown. In hiring the optimal number of units of labor the firm requires information on the MP at each level of employment. Consequently the concept of marginal productivity is critical to efficiency in the theory of supply.

Example. The marginal product of labor can be derived from the total product schedule of the example in 3.4.2.

Table 3.4.7.3(1) The Marginal Product of Labor employed in Catching Mackerel

N	TP	(kilos) AP	(kilos) MP
0	0	0	
1	1	1	1
2	10	5	9
3	36	12	26
4	80	20	44
5	130	26	50
6	210	35	80
7	238	34	28
8	264	33	26
9	288	32	24
10	310	31	22
11	330	30	20
12	348	29	18
13	364	28	16
14	378	27	14
15	384	25.6	6
16	384	24	0

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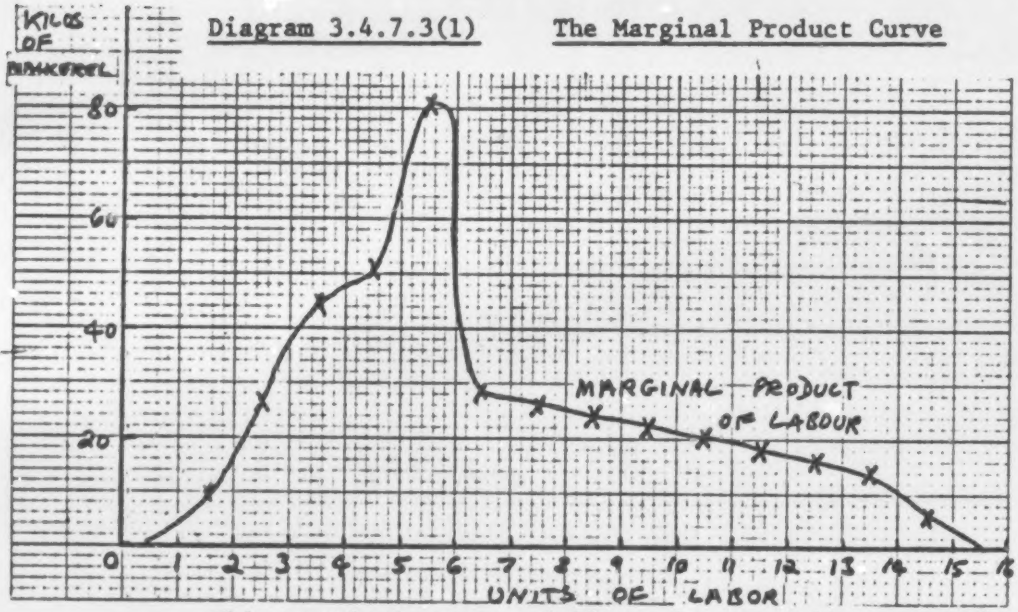
The employment of the first worker results in 1 kilo of mackerel caught. The addition of another worker adds 9 kilos to the catch, given that the first worker is already employed. Thus the ML_l when one worker is already employed $= \frac{Q}{L} = \frac{9}{1}$ i.e. $\frac{(10 - 1)}{1}$ The addition of the 3rd worker adds 26 kilos to the catch, while the addition of the 4th worker adds 44 kilos. Thus the total output (catch) of 4 workers is $1 + 9 + 26 + 44 = 80$ kilos, i.e. the sum of the marginal products of L up to the number of units employed.

Marginal product increases up to a point, and reaches a maximum when 5 workers are employed, since the 6th worker would add more to output than any previous or subsequent worker.

Note: Marginal products usually are not attributed to individual workers. The 12th worker, for example, does not catch 18 kilos of mackerel; he may prepare bait. When 11 workers are employed and a 12th is added the total catch increases by 18.

The marginal product of labor is shown diagrammatically below:

Diagram 3.4.7.3(1) The Marginal Product Curve



This particular curve follows the generally accepted pattern of marginal product curves: it increases up to some maximum and then diminishes to zero.

(Note: the analysis of total, average and marginal product has been discussed in terms of output produced, i.e. physical units of output. For this reason the terms should be strictly defined/

defined as Total Physical Product, Average Physical Product, and Marginal Physical Product. When output units are expressed in money terms a different terminology will be used; unless otherwise stated TP, AP and MP will refer to physical units of output.)

3.4.7.4 Starting with the total product schedule, the average and marginal product schedules of the variable factor input were derived. It follows that there will be a number of relationships between these three variables. The most important of these are as follows:

i) When TP = 0, AP = 0

ii) When AP is maximum, AP = MP

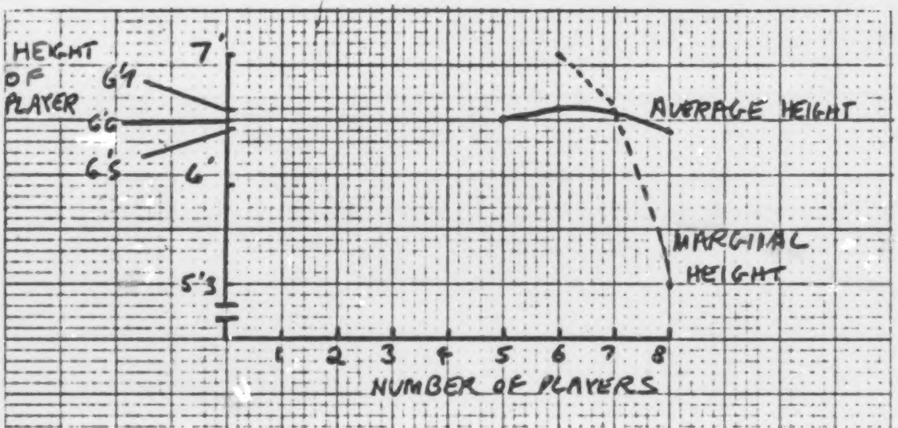
iii) When MP is greater than AP, AP is increasing

iv) When MP is less than AP, AP is decreasing

v) When the change in TP = 0, MP = 0

Example. Suppose a basketball squad of 5 players has an average height of 6'6" and three additional players are added to the pool by height, i.e. tallest first, smallest last. The three reserves are 7', 6'7" and 5'3". When the player is added whose height is greater than the average, it follows that the average height of the pool must rise, i.e. the addition of the 7' player increases the average height from 6'6" to 6'7". The addition of the 6'7" player neither raises nor lowers the average height at this stage because his height is equal to the average. The addition of the 5'3" player has the effect of reducing the average to 6'5". The following diagram shows what happens to the average height of the basketball pool when the three players are added.

Diagram 3.4.7.4(1) The Height of the Basketball Pool

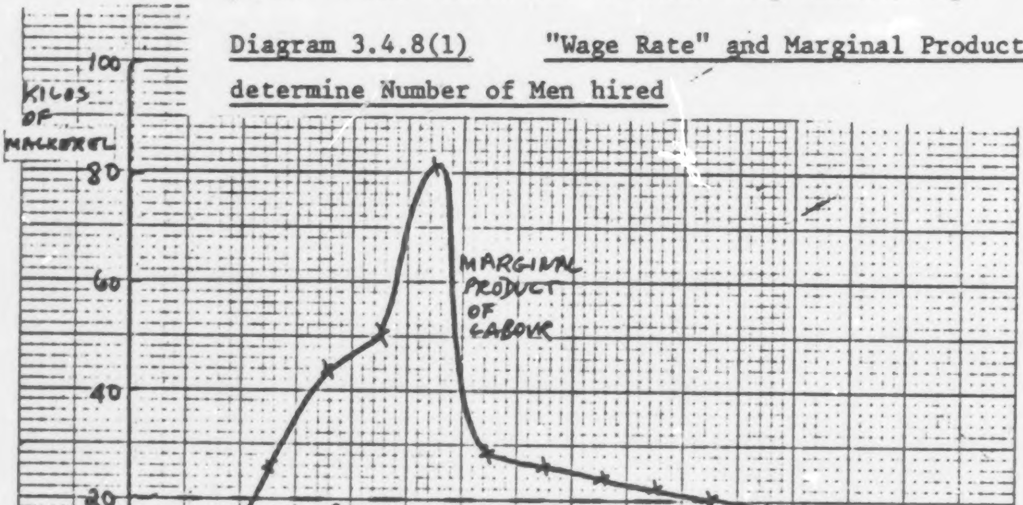


3.4.8 The marginal product concept is of fundamental importance to decision making on the part of the firm. The rule which a profit maximizing firm must follow in hiring factors of production is: the firm will continue to hire a factor of production up to the point at which the value of its marginal product just equals the going rate or unit cost of the factor hired.

Example. Assume that a mackerel catching firm has to pay the going rate of 20 kilos of mackerel for each unit of labor hired. How many units of labor (man days) will the firm of 3.4.2 hire? It will pay the firm to hire labor up to the point at which the $MP_L = 20$ *kilos of mackerel, i.e. the firm will hire 10 men and since the* MP_L *when 10 men are hired* $=20$*, the firm will be indifferent about hiring the 11th man. If the firm were to hire a 12th man the additional cost to the firm would be 20 kilos of mackerel (the going rate) but the additional catch would only be 18 kilos. Hiring of the 12th man would involve the firm in a net loss of 2 kilos of mackerel.*

Note: The hiring of 12 men would cost the firm 240 kilos of mackerel (20 x 12) and the resulting catch would be 348 kilos, yielding a net catch to the owner of the firm of 108 kilos (348 - 220), or if only 10 men are hired, 110 kilos (310 - 200). This is an application of the marginal analysis of 1.3 and yields the correct output decision for the profit maximizing firm. This result can be shown diagrammatically:

Diagram 3.4.8(1) "Wage Rate" and Marginal Productivity Curve determine Number of Men hired



The going wage rate is encountered twice on the MP_L *schedule, but the increasing portion of the curve is irrelevant to profit maximizing behavior.*

3.4.9 The next step in investigating firm supply requires the conversion of productivity data to cost data. This is necessary because the productivity results are particular to the firm analyzed, while the conversion to a unit of exchange (money) allows conclusions of greater generality to be drawn. The same assumptions are used as in the productivity analysis, i.e. that the firm is analyzed in the short run using 2 factors of production, that it is a price taker in the market for factors of production and its output, and that it is a profit maximizer.

3.4.9.1 The total cost of producing any good equals the amount of each factor of production employed multiplied by the price of each of these factors.

Example. The total cost of catching mackerel will be determined by the rental cost of the boat and the number of men, rods, etc. hired, times their respective unit costs, i.e.

$TC = Cp_c + Lpe$

Note: $TC = C_1p_1 - C_np_n + L_1p_1 - L_np_n$

3.4.9.2 The total cost of production is comprised of two elements. First, the cost of the fixed factor which the firm must pay even if it produces zero output. Since the quantity of the fixed factor does not vary with the level of output the cost of the fixed factor does not vary with the level of output. This cost is known as fixed cost. Second, the cost of the variable factor, on which the firm's spending will vary with the amount of the factor hired. This cost is known as variable cost.

Thus TC = VC + FC where TC = total cost
VC = variable cost
FC = fixed cost

Example. Using the example of 3.4.2, assume that the fixed cost is $100 (i.e. the cost of the boat, rod, bait, etc.) to the firm each day. Further, assume that each unit of labor, i.e. one 24 hour day, is $100. Table 3.4.9.2(1) shows the cost of each amount of mackerel caught calculated from the productivity data in 3.4.2.

Table 3.4.9.2(1) The Total Cost of Catching Mackerel

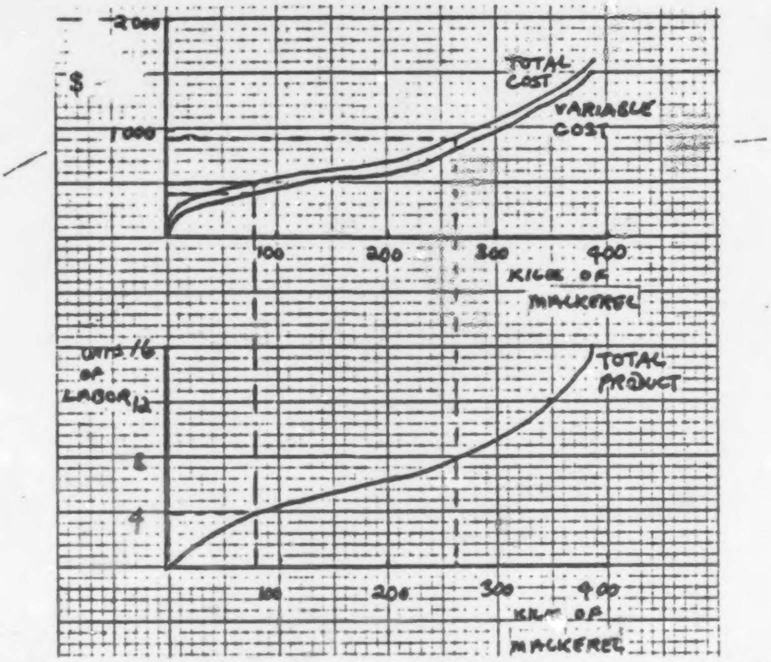
Total Product (Kilos of Mackerel)	Fixed Cost ($)	Units of Labour	Price per Unit of Labour ($)	Variable Cost ($)	TC=VC+FC
0	100	0	0	0	100
1	100	1	100	100	200
10	100	2	100	200	300
36	100	3	100	300	400
80	100	4	100	400	500
130	100	5	100	500	600
210	100	6	100	600	700
238	100	7	100	700	800
264	100	8	100	800	900
288	100	9	100	900	1000
310	100	10	100	1000	1100
330	100	11	100	1100	1200
348	100	12	100	1200	1300
364	100	13	100	1300	1400
378	100	14	100	1400	1500
384	100	15	100	1500	1600
384	100	16	100	1600	1700

The table shows the total cost associated with each level of output; for example, 264 kilos of mackerel cost a total of $900 to catch. This cost is comprised of FC = $100 + VC = $800.

3.4.9.3 Since increases in output require increases in factor inputs total cost of production will increase as output increases. However, since a given increase in the amount of the variable factor of production employed does not necessarily result in proportional increases in output (3.4.5), the relationship between cost of production and output will be positive but not necessarily fixed.

Example. In diagram 3.4.9.3(1) output and cost data (Table 3.4.9.2(1)) and output and variable input data (Table 3.4.2(1)) are plotted.

Diagram 3.4.9.3(1) **Total and Variable Costs related to Productivity**



The relationships between the various curves can be traced out. For example, 4 units of labor, given fixed factor inputs, produce a catch of 80 kilos of mackerel (point A). The cost of 80 kilos of mackerel is $500 (point B), which can be broken down into variable cost of $400 (point C) and fixed cost $100 ($500 - $400).

Eight units of labor input yield a total catch of 264 kilos of mackerel. The concomitant total cost is $900 of which VC = $800 and FC = $100, i.e. a doubling of the variable input results in much more than a doubling of output.

The shape of the total cost curves are thus determined by the shape of the productivity curves.

3.4.9.4 Average Cost: the average cost of output for each level of production (average cost of production) is calculated by dividing total cost by output, i.e.

ATC = TC/Q where ATC = average total cost

TC = total cost

Q = output

Similarly, AVC = VC/Q where AVC = average variable cost. Since TC = VC + FC (3.4.9.2) then TC/Q = VC/Q + FC/Q, i.e. ATC = AVC + AFC.

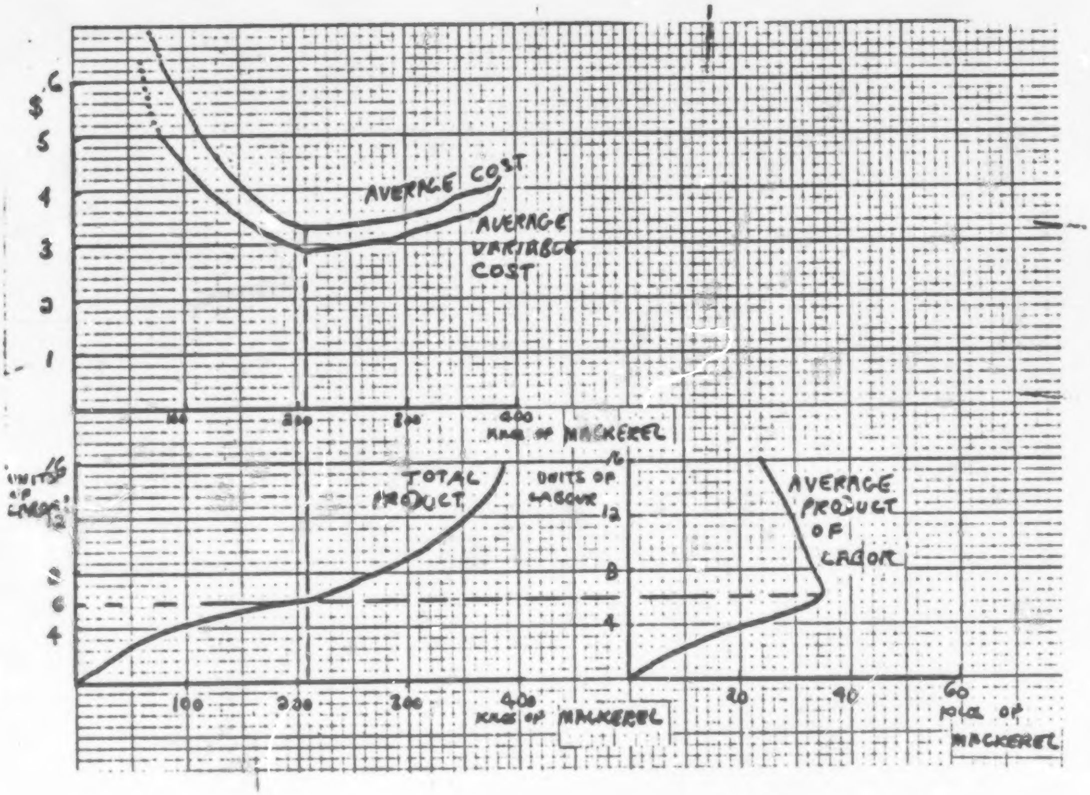
Example. The ATC and AVC can be found by performing the calculations on the data in Table 3.4.9.2(1) to give the following:

Table 3.4.9.4(1) Average Total Cost, Average Variable Cost and Average Fixed Cost

TP	ATC	AVC	AFC
1	200.00	100.00	100.00
10	30.00	20.00	10.00
36	11.11	8.33	2.78
80	6.25	5.00	1.25
130	4.62	3.85	0.77
210	3.33	2.86	0.47
238	3.36	2.94	0.42
264	3.41	3.03	0.38
288	3.47	3.13	0.34
310	3.55	3.23	0.32
330	3.64	3.33	0.31
348	3.74	3.45	0.29
364	3.85	3.57	0.28
378	3.97	3.70	0.27
384	4.17	3.91	0.26
384	4.43	4.17	0.26

As output increases, AFC decreases since a fixed amount is being divided by an ever-increasing number of units of output. Consequently, the greater is output the smaller will be AFC and consequently the smaller will be the difference between ATC and AVC. The data in Table 3.4.9.4(1) are plotted in conjunction with the productivity data in Table 3.4.7.2(1) to illustrate the general pattern of average cost and the relationship between average productivity and average costs.

Diagram 3.4.9.4(1) Average Cost and Average Productivity Curves



The shape of the AVC is inversely related to the AP_L*: when AVC is minimum, i.e. at 210 units of output,* AP_L *is maximum, i.e. 35 units. Thus the shape of the AVC curve is determined by the shape of the* AP_L *curve.*

3.4.9.5 Marginal cost: the marginal cost is the cost of producing an additional unit of output, i.e.

$C_{n+1} - C_n$ where C_n = cost of producing n units of output

C_{n+1} = cost of producing n+1 units of output.

Example. The data in the fishing boat example do not yield the marginal cost of kilos of mackerel directly, i.e. the cost of catching an additional kilo of mackerel at each level of output. Instead, the data tell the number of additional mackerel /

mackerel caught for the addition of one unit of labor for each number of units already employed. An approximation to the marginal cost of mackerel at each level of output can be calculated by dividing the increase in costs associated with hiring one additional unit of labour by the extra mackerel caught. For example, the hiring of the 5th unit of labor causes output to increase from 80 kilos of mackerel to 130 kilos, i.e. an increase of 50 kilos of mackerel. The cost of the 5th unit of labor is $100. Thus the cost of catching 50 additional kilos of mackereal when 80 were already being caught is $100. Thus the cost of each additional kilo of mackerel on average is $2 ($100/50); this is the marginal cost of mackerel when 80 are being caught. If, when 80 kilos of mackerel are already caught, 1/50th of a unit of labor could be hired for $2 and if 1/50th of a unit of labor caught 1 additional kilo of mackerel the same result would be achieved.

The data available, therefore, because of discontinuities, yield the "average marginal cost of kilos of mackerel". The marginal cost of mackerel is set out in Table 3.4.9.5(1).

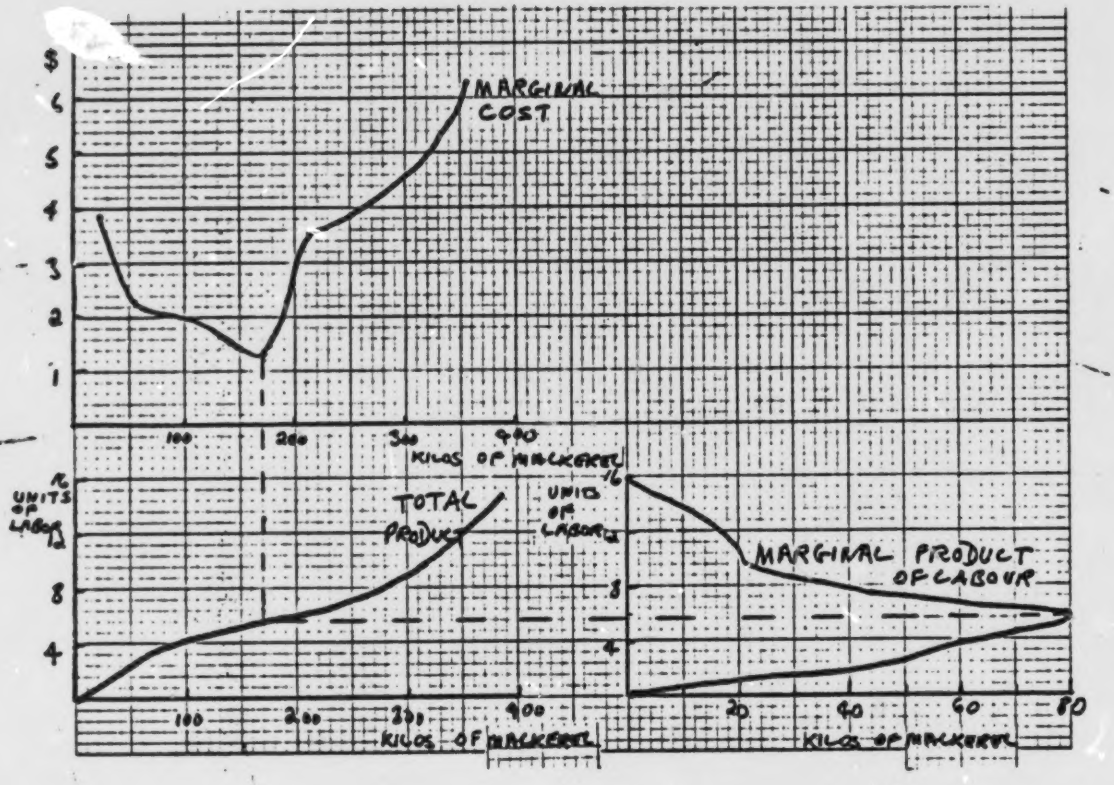
Table 3.4.9.5(1) The Marginal Cost of Kilos of Mackerel

TP	MP	Wage Rate	Marginal Cost
0	1	100	100.00
1	9	100	11.11
10	26	100	3.85
36	44	100	2.27
80	50	100	2.00
130	80	100	1.25
210	28	100	3.57
238	26	100	3.85
264	24	100	4.17
288	22	100	4.55
310	20	100	5.00
330	18	100	5.56
348	16	100	6.25
364	14	100	7.14
378	6	100	16.67
384	0	100	
384		100	

The marginal cost is high at low levels of output, declines to $1.25 and thereafter increases. It is clear that the marginal cost is determined by the MP_l *and the cost of L.*

The marginal cost curve is plotted in Diagram 3.4.9.5(1) together with the MP_l*.*

Diagram 3.4.9.5(1) **The Marginal Cost Curve of Kilos of Mackerel**



The lowest point of marginal cost occurs in the range of output 130 to 210, and in this range of output the marginal product of labor is highest. Given the price of the variable factor of production is constant, the shape of the marginal cost curve is therefore determined by the shape of the MP_l curve.

3.4.9.6 Starting with the total cost, the average total, average variable and marginal costs were derived, and it follows that there are a number of relationships between these three variables. The most important of these are as follows:

i) When Q = 0, TVC = 0 and TC = FC

ii) When ATC is a minimum, ATC = MC

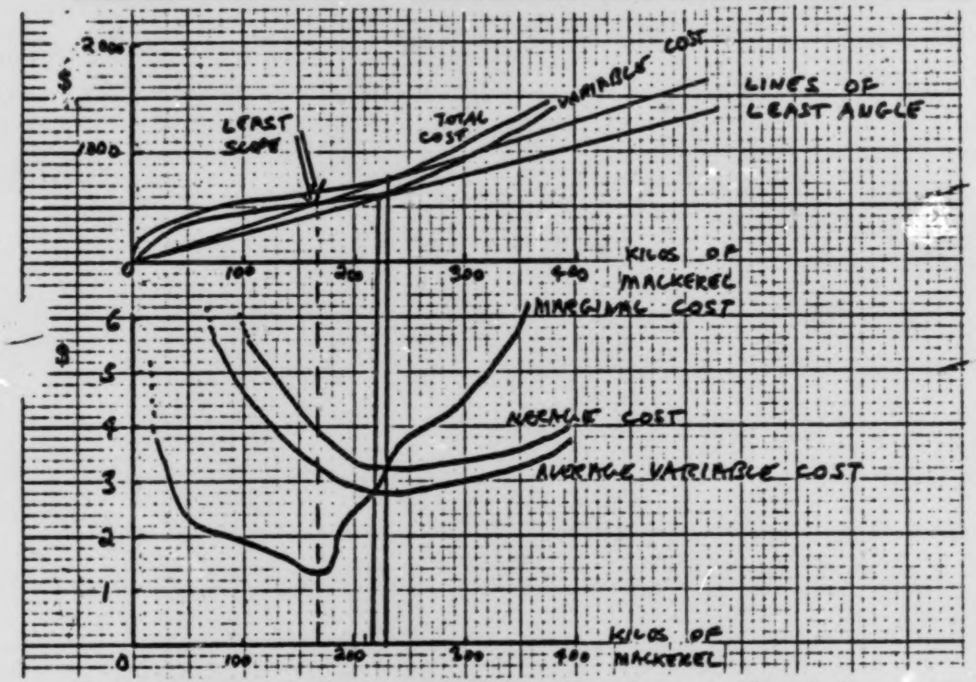
iii) When AVC is a minimum, AVC = MC

iv) When MC is greater than AC, AC is increasing

v) When MC is less than AC, AC is decreasing

Example. Similar to the derivation of MP and AC curves from the TP curve in 3.4.7.4, AC and MC are derived from TC, and the diagrammatic relationships between the curves are shown in Diagram 3.4.9.6(1).

Diagram 3.4.9.6(1) The Relationships Between Cost Curves



The features of these curves are based on productivity. In the range of output where MP_l *is maximum, the MC of output (the slope of the TC curve) is minimum. Where* AP_l *is maximum, AVC is minimum. When AP is increasing, AVC is decreasing. The reasoning behind the characteristics of the different curves and the connections between them is similar to the basketball squad example of 3.4.7.4.*

3.5 Firm Supply in the Short Run

3.5.1 The productivity and cost relationships provide the base for determining how much output a firm will supply. In analyzing firm supply in the short run the assumptions of the firm producing only one good and being a price taker in both product and factor markets will be maintained. How much output will the firm supply to meet its objective of profit maximization? Profits are maximized when total revenue - total cost is maximum, i.e., P x Q - TC is a maximum.

Example. Suppose the selling price of mackerel is $5 per kilo. Using the total cost curve of the mackerel fishing boat it is possible to compare the revenues obtained from selling each quantity of mackerel with the costs of producing it. Table 3.5.1(1) sets out the total cost of producing mackerel from Table 3.4.9.2(1) with the revenue from each level of sales.

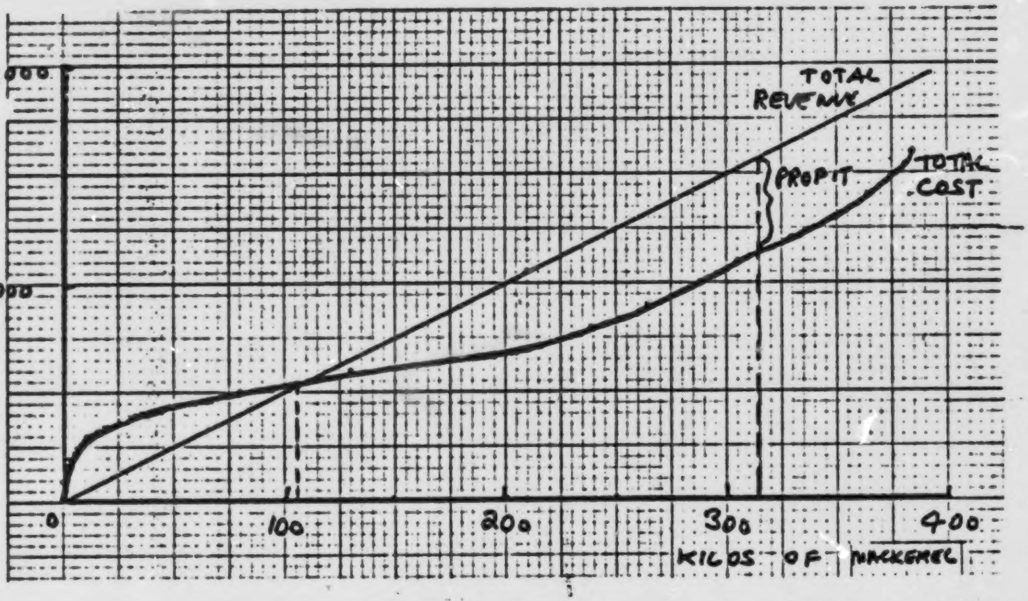
Table 3.5.1(1) Revenues, Costs and Profits

Total Product (Kilos of Mackerel)	Total Cost	Total Revenue (TP x $5)	Profit (TR-TC)
0	100	0	-100
1	200	5	-195
10	300	50	-250
36	400	180	-220
80	500	400	-100
130	600	650	50
210	700	1050	350
238	800	1190	390
264	900	1320	420
288	1000	1440	440
310	1100	1550	450
330	1200	1650	450
348	1300	1740	440
364	1400	1820	420
378	1500	1890	390
384	1600	1920	320
384	1700	1920	220

It is clear that the level of output giving maximum profit lies between 310 and 330 units.

The data can be presented in diagram form as in Diagram 3.5.1(1), in which the total cost curve is reproduced from Table 3.4.9.2(1) and the total revenue curve is a straight line drawn from the origin through the points in the total revenue column of Table 3.5.1(1).

Diagram 3.5.1(1)   Revenues, Costs and Profits



It can be seen that there is one level of output between 310 and 330 where the difference between total cost and total revenue is a maximum.

3.5.2 Outputs where total cost = total revenue are known as "break even" points.

Example. In Table 3.5.1 the firm's total costs are greater than total revenues up to the range of output 80 to 130; between these two outputs exists a level of output at which total cost and total revenue are equal, i.e. the break even point. Above this range of output total cost is less than total revenue, i.e. the firm is making a profit. The problem which faces the firm is not to find the break even point but to find the profit maximizing level of output.

3.5.3 The selling price will determine whether the firm is able to cover its total cost of production; there are three distinct cases depending on the selling price:

i) the firm is able to cover all costs at certain levels of output and make a profit.

ii) the firm is able to cover variable cost but not total cost at certain levels of output.

iii) the firm is unable to cover variable cost at any level of output.

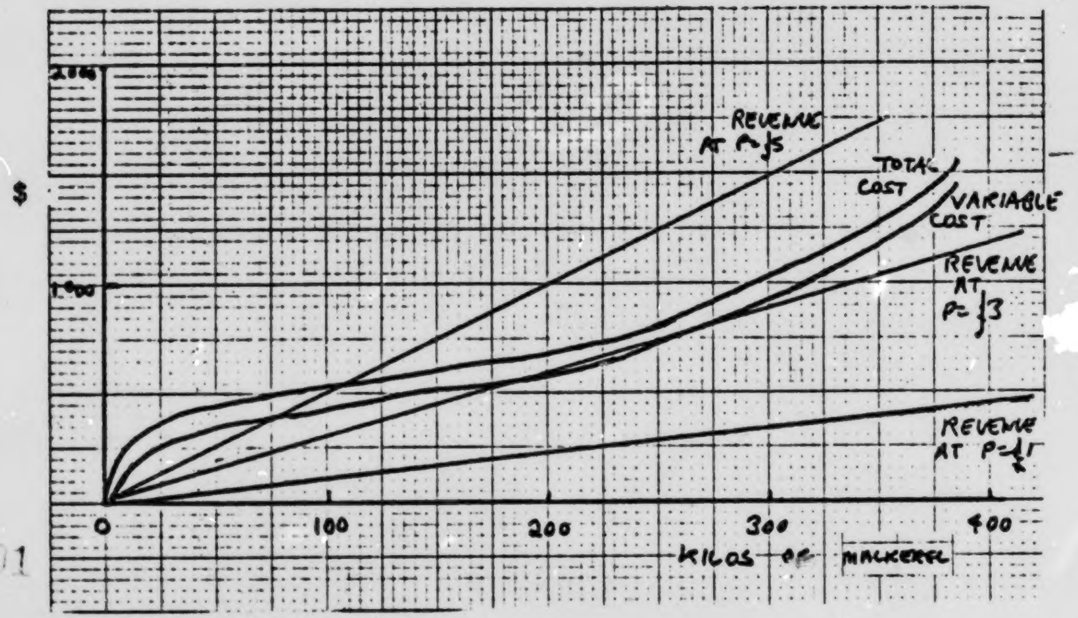
Example. *Table 3.5.3(1) elaborates on Table 3.5.1(1) by including the revenues and profits associated with selling prices of $1, $3 and $5.*

Table 3.5.3(1) **Revenues and Profits at Different Selling Prices**

Total Product	Total Cost	Variable Cost	Total Revenue at $1	$3	$5	Profit (TR-TC) at $1	$3	$5
0	100	0	0	0	0	-100	-100	-100
1	200	100	1	3	5	-199	-197	-195
10	300	200	10	30	50	-290	-270	-250
36	400	300	36	108	180	-364	-292	-220
80	500	400	80	240	400	-420	-260	-100
130	600	500	130	390	650	-470	-210	50
210	700	600	210	630	1050	-490	-70	350
238	800	700	238	714	1190	-562	-86	390
264	900	800	264	792	1320	-636	-108	420
288	1000	900	288	864	1440	-712	-136	440
310	1100	1000	310	930	1550	-790	-170	450
330	1200	1100	330	990	1650	-870	-210	450
348	1300	1200	348	1044	1740	-952	-256	440
364	1400	1300	364	1092	1820	-1036	-308	420
378	1500	1400	378	1134	1890	-1122	-366	390
384	1600	1500	384	1152	1920	-1216	-448	320
384	1700	1600	384	1152	1920	-1316	-548	220

While a profit is made at the selling price of $5 above the 80 to 130 range of output, neither selling prices of $1 nor $3 result in a profit at any level of output. However, at 210 and 238 units of output the selling price of $3 results in a revenue which is greater than variable cost, i.e. the firm is able to cover its variable cost and make some contribution to fixed cost. This situation is represented in Diagram 3.5.3(1).

Diagram 3.5.3(1) **Revenue and Cost Curves**

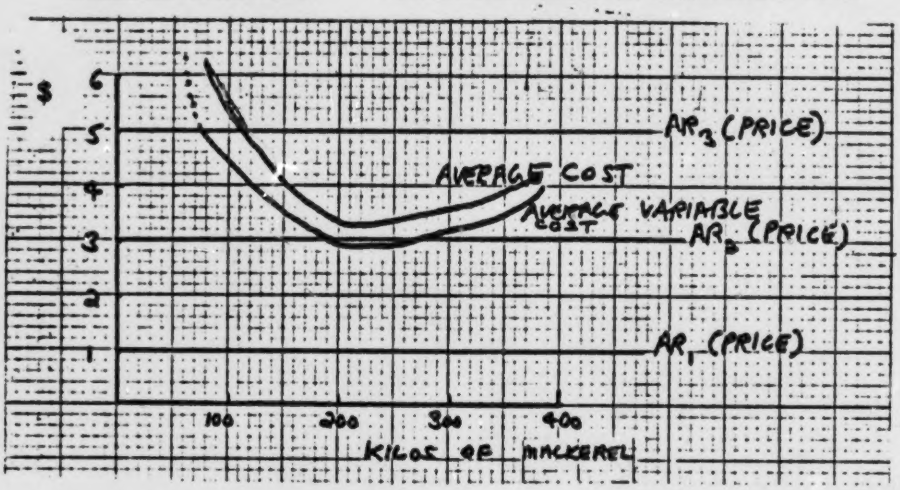


In the diagram the revenue curve for $3 never rises above the total cost curve but for a certain range of output it lies between the variable and the total cost curves. The revenue curve for $1 lies below both curves at all levels of output.

3.5.4 The same solution can be achieved by considering average revenue and average costs. Average revenue is calculated by dividing total revenue by output. If each unit sells for the same price average revenue will be constant and equal to price, for example if each of 10 pencils sells for 15c., total revenue from the sale of 10 pencils will be $1.50 and average revenue will be 15c., which equals price.

Example. Diagram 3.5.4(1) contains the average variable and average total costs from Diagram 3.4.9.4(1) together with the total revenue curves of Diagram 3.5.3(1) expressed as average revenue (price) curves.

Diagram 3.5.4(1) Average Revenue and Average Cost



At all levels of output the average revenue curve at a price of $1 per kilo lies below the average variable cost curve; there is a range of output for which the average revenue curve at a price of $3 lies between the average variable cost and the average total cost, and there is a range of output for which the average revenue curve at a price of $5 lies above the average total cost, i.e. the firm is making a profit.

3.5.5 An alternative to comparing TC and TR for all production levels to find the profit maximizing output of the firm is to employ the technique of marginal analysis (1.5). The profit maximizing level of output occurs where MR = MC.

MR is the revenue obtained by the firm from selling one additional unit of output. When the selling price is given (fixed) MR will equal price.

MC is the cost to the firm of producing one additional unit.

When MR > MC the firm will expand output because each additional unit produced will add more to TR than to TC, and consequently profit will be increased (or loss decreased).

When MR < MC the firm will reduce output because the decrease in revenue will be less than the decrease in cost, and consequently profit will be increased (or loss decreased).

Note: for this condition to hold MC must be increasing.

When the firm reaches an output level at which MR = MC, profit will be maximized since any increase or decrease in output will diminish profit.

Example. The data in Table 3.5.5(1) are derived from the estimates of marginal cost in Table 3.4.9.5(1) and the profit data in Table 3.5.1(1).

Table 3.5.5(1) Marginal Cost and Profit Maximization

Total Product	Total Revenue	Total Cost	Marginal Cost	MR=AR =Price	Profit
0	0	100			-100
1	5	200	100.00	5	-195
10	50	300	11.11	5	-250
36	180	400	3.85	5	-220
80	400	500	2.27	5	-100
130	650	600	2.00	5	50
210	1050	700	1.25	5	350
238	1190	800	3.57	5	390
264	1320	900	3.85	5	420
288	1440	1000	4.17	5	440
310	1550	1100	4.55	5	450
330	1650	1200	5.00	5	450
348	1740	1300	5.56	5	440
364	1820	1400	6.25	5	420
378	1890	1500	7.14	5	390
384	1920	1600	16.67	5	320
384	1920	1700			220

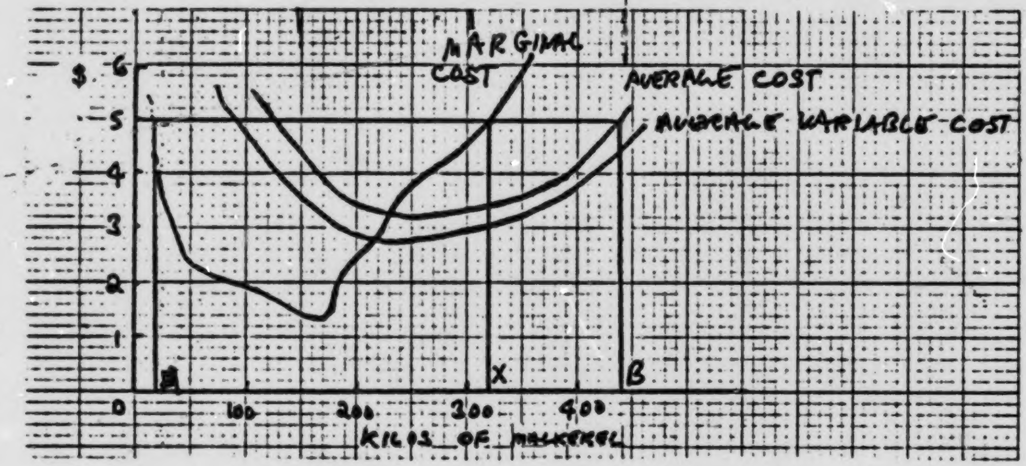
In this case marginal cost equals price, i.e. $5, at the range of output 310 to 330. At this range of output the firm is achieving maximum profit.

Note that the firm could achieve maximum profit of 450 by producing either 310 or 330 units of output, i.e. by hiring either 10 or 11 units of labor (3.4.8). If labor were divisible into very small amounts the profit maximizing level of output would lie between 310 and 330 units of output.

At an output of 364 units the marginal cost is $7.14 and the price is still $5, hence total profit would be increased by reducing output. Similarly, if output were 210 units, additional units of output would add less to cost than $5, up to the point at which MC = MR.

Diagram 3.5.5(1) reproduces the cost data for 3.5.4 and includes the marginal cost curve.

Diagram 3.5.5(1)   Marginal Cost and Profit Maximization



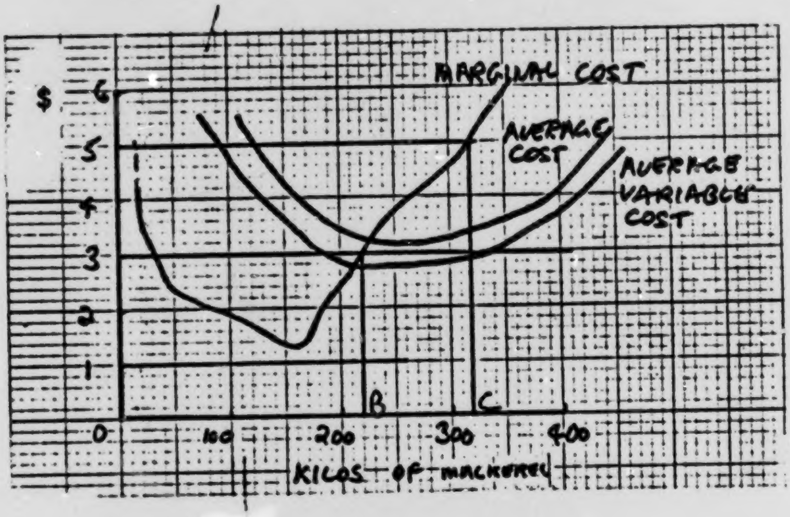
At output levels less than X (i.e. the profit maximizing level of output between 310 and 330 units of output) MR is greater than MC and the firm will add more to TR than to TC by increasing output; the opposite applies to levels of output above X.

Note: for outputs between A and B, AR is greater than ATC and within this range the firm would make a profit; however, only X units of output will yield maximum profit.

3.5.6 Since a profit maximizing firm will produce up to the output at which MR = MC, given that the firm can cover its variable costs, the MC curve of the firm from its point of intersection of the AVC curve (i.e. its minimum point) will be the firm's short run supply curve, i.e. it will indicate the quantities of output a profit maximizing firm will be willing to produce at each price.

Example. Diagram 3.5.6(1) reproduces Diagram 3.5.5(1) together with the three different prices for mackerel.

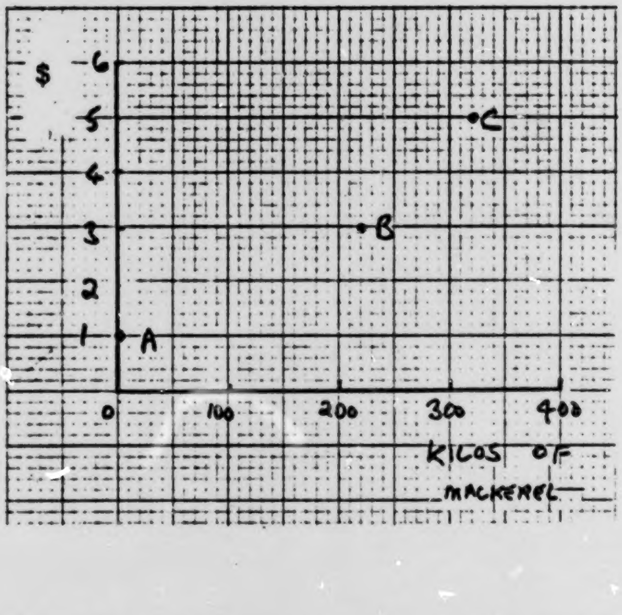
Diagram 3.5.6(1)



At a price of $5 the firm will produce OC kilos of mackerel, at a price of $3 B kilos and at a price of $1 the firm will produce zero (not OA) kilos of mackerel because variable costs can not be covered at that price. Diagram 3.5.6(2) contains these three points on the firm's short run supply curve:

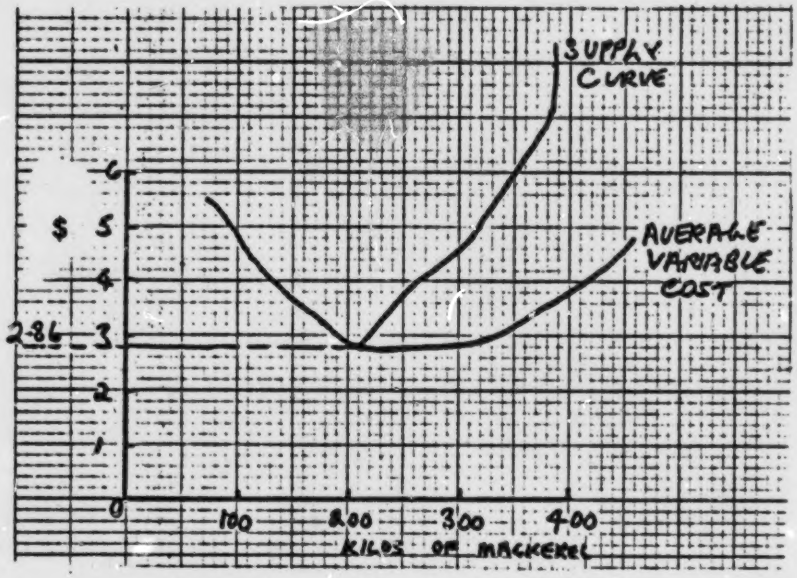
Price	*Quantity*
$5	*C*
$3	*B*
$1	*O*

Diagram 3.5.6(2) Three Points on the Firm's Short Run Supply Curve



For prices less than $2.86 the firm will supply zero output (the minimum level of AVC). For all prices greater than $2.94 the profit maximizing outputs will be determined by the intersection of each price (MR) line with the MC curve. Thus the firm's short run supply for all prices less than $2.86 will be the vertical axis. For all prices greater than $2.86 the firm's short run supply curve will be the firm's MC curve. Note: the firm's short run supply curve will become a vertical line when the MP_l *is zero, i.e. the firm is unable to produce any additional output in the short run no matter how high the price. Diagram 3.5.6(3) shows the short run supply curve for the fishing boat.*

Diagram 3.5.6(3) The Short Run Supply Curve of the Mackerel Boat



3.5.7 The firm's short run supply curve will shift if the per unit cost of the variable factor of production changes.

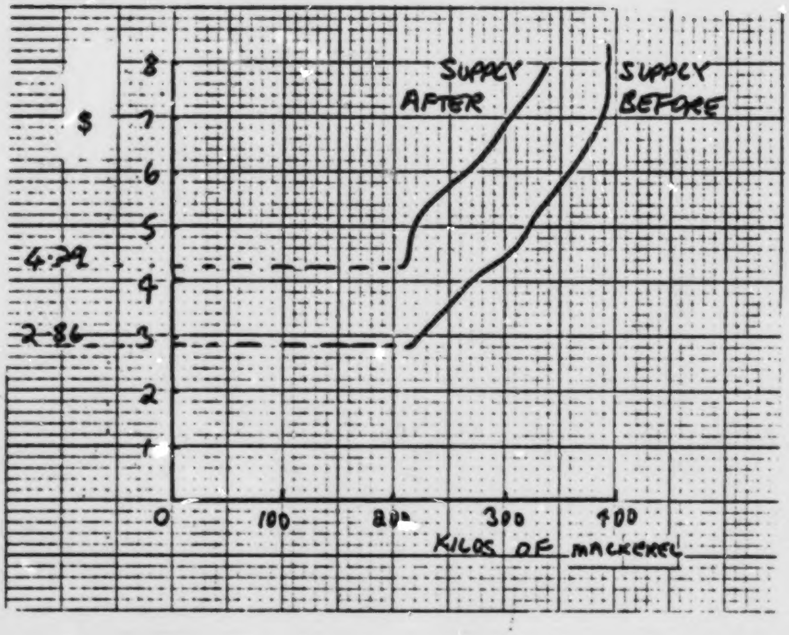
Example. In 3.4.9.5 the marginal cost of production was calculated on the basis of a wage rate of $100 per day. The following data in Table 3.5.7(1) show the effect on marginal cost of an increase in the wage rate (cost of the variable factor) to $150 per day.

Table 3.5.7(1) **Change in Wage Rates; Change in Marginal Cost**

TP	MP	AVC Before (wage=$100)	 After (wage=$150)	MC Before	 After
0			—		
1	1	100.00	150.00	100.00	150.00
10	9	20.00	30.00	11.11	16.67
36	26	8.33	12.50	3.85	5.77
80	44	5.00	7.50	2:27	3.41
130	50	3.85	5.78	2.00	3.00
210	80	2.86	4.29	1.25	1.88
238	28	2.44	4.41	3.57	5.36
264	26	3.03	4.55	3.85	5.78
288	24	3.13	4.70	4.37	6.26
310	22	3.23	4.85	4.55	6.83
330	20	3.33	5.00	5.00	7.50
348	18	3.45	5.18	5.56	8.34
364	16	3.57	5.36	6.25	9.38
378	14	3.70	5.55	7.14	10.71
384	6	3.91	5.87	16.67	25.01
384	0	4.17	6.26		

The effect on the supply curve of the change in wage rates has two distinct aspects. First, the minimum price at which the firm will be prepared to supply more than zero is increased from $2.86 to $4.29, i.e. the minimum AVC has increased. Second, at each price the firm will be willing to supply less than before the increase in wage rates; a price of $7 would have resulted in an output of 364 units before and 310 units after the change. The shift in the supply curve is shown in Diagram 3.5.7(1).

Diagram 3.5.7(1) **A Shift in the Supply Curve**



Note: changes in productivity of the firm's variable factor of production would cause the supply curve to shift but for this to occur the firm would have to be already producing in an engineering inefficient manner and/or the fixed factor would have to alter. For example, if the mackerel fishing boat moved to a better fishing ground it could not have been producing to maximum efficiency previously, and if superior rods were supplied the fixed factor would have changed.

3.6 Industry Supply in the Short Run

3.6.1 An industry is comprised of a number of firms. The industry supply is the summation of the amount which each firm would be willing to supply at each price, i.e. industry supply is the summation of the supply curves of the firms in the industry.

Example. Suppose mackerel are supplied in a small town by three firms. Captain Joe owns two large modern fishing boats, Captain Harry owns one large modern fishing boat, and Captain Sam owns one small old boat. Table 3.6.1(1) contains data on the amount of mackerel each is willing to produce at different prices, and by summing these quantities the total short run supply of mackerel in the market, i.e. the industry supply.

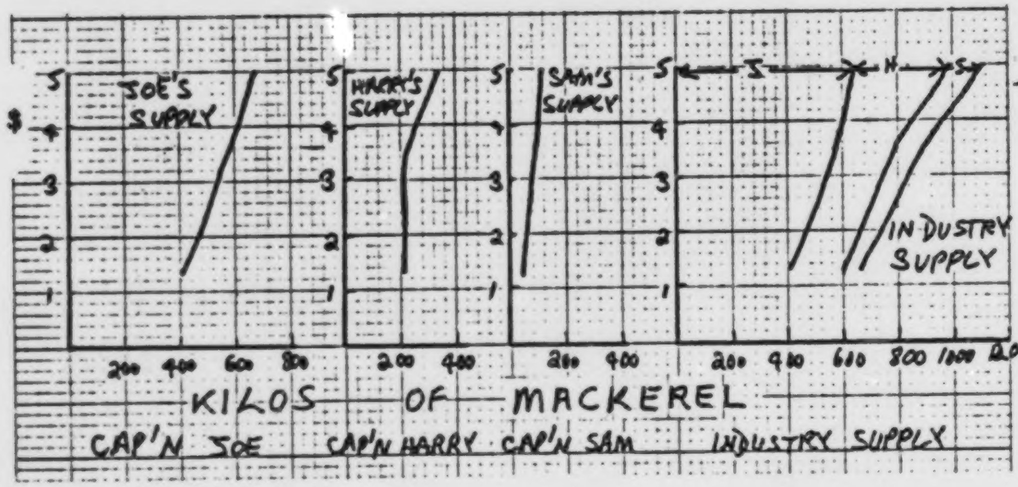
The data for Captain Harry are the data contained in Table 3.5.5(1), and the data for the other two firms have been derived in a similar fashion.

Table 3.6.1(1) The Industry Supply of Mackerel

Price $	Captain Joe's Supply	Captain Harry's Supply	Captain Sam's Supply	Industry Supply
0.00	0	0	0	0
1.25	420	210	40	670
3.57	576	238	86	900
5.00	660	330	110	1100

Each firm pays the same for each unit of labor hired, i.e. the difference in the firms' supply curves are due to differences in the capital (fixed factor) owned. The data for Table 3.6.1(1) are plotted in Diagram 3.6.1(1).

Diagram 3.6.1(1) The Industry Supply Curve for Mackerel

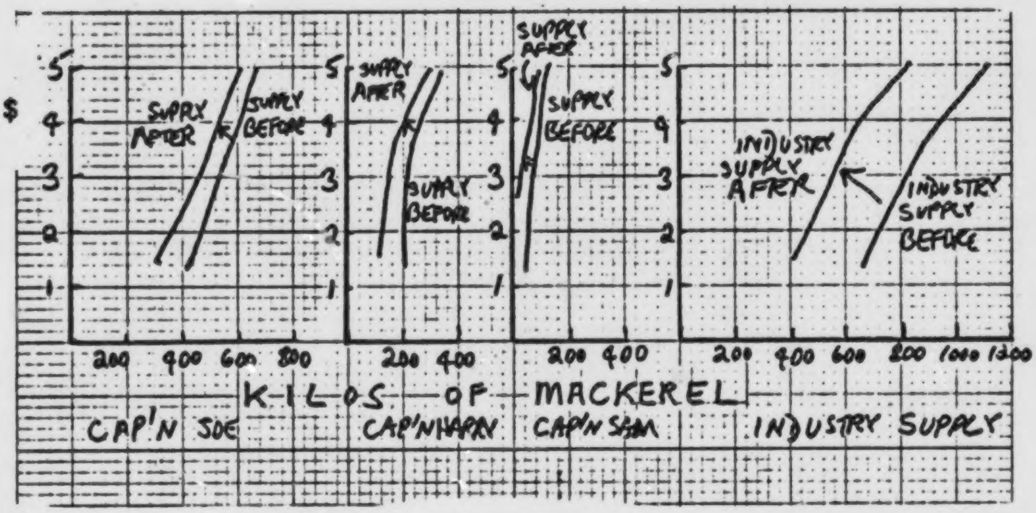


Each firm's short run supply curve is its MC curve above the intersection point with its AVC curve and the industry supply is the summation of the individual firm's supply curves.

3.6.2 **A change in the price of the variable factor input will shift each firm's supply curve and consequently the supply curve for the industry.**

Example. A large construction firm moves into the town and by offering higher rates of pay than the fishing industry forces the owners of fishing boats to increase their wages by 50% in order to keep their crews. It was shown in 3.5.7 how such an increase in the price of the variable factor resulted in a shift of the supply curve of Captain Harry's fishing boat (firm). Since Captains Joe and Sam hire labor in the same market the increase in labor costs will cause their supply curves to shift in the same direction, i.e. to the left. Diagram 3.6.2(1) shows each firm's supply curves and the industry supply curve before (3.6.1(1)) and after the increase in labor costs.

Diagram 3.6.2(1) Shift in the Supply Curves of the Firms and Industry



3.7 Firm Supply in the Long Run

3.7.1 In the theory of supply in the short run it is assumed (3.3.6) that the firm operates in a time period in which one factor (capital) is fixed and one factor (labor) is variable. In the long run all factors are variable, i.e. assumption 3.3.6 is relaxed, and the firm seeks the profit maximizing output by varying both capital and labor.

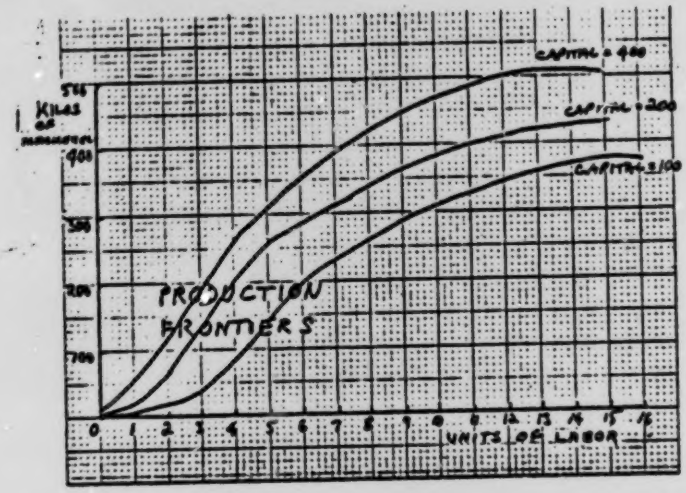
Example. The fishing boat firm may be considering how to increase output after hiring 15 men on the one mackerel boat already owned. The only way to do so is to buy another boat, since hiring another unit of labor will not increase output (3.4.2). The decision which the firm must make in the long run, i.e. when an addition to capital is made by buying another boat, is similar to that in the short run: will an increase in capital add more to revenues than to costs? If it does not then the profit maximizing firm will not increase its capital.

3.7.2 When a firm makes a long run decision it changes the amount of capital hired. Once the capital has been hired the firm is once again in the short run, in which capital (new plus old capital) is fixed and the quantity of labor hired (variable factor) can be varied.

Example. When Captain Harry is considering adding to his fleet of fishing boats he is contemplating a long run decision. However, once he has bought an additional boat he is in a short run decision making period and the amount of fish he will be willing to produce (and the number of men he will hire) will be determined by the price of fish and his new marginal cost curve, i.e. his new short run supply curve.

Diagram 3.4.2(1) shows the production frontier for a fixed input of $100 and variations in labor input. It can be assumed that the addition of one fishing boat to Captain Harry's fleet adds $100 to the fixed cost, and the addition of a modern and much more sophisticated boat will add a further $200 to the fixed cost. With each of these two higher levels of fixed cost a production frontier can be traced which will follow the pattern of the original production frontier. This is shown in Diagram 3.7.2.

Diagram 3.7.2 (1) Production Frontiers and Different Amounts of Capital

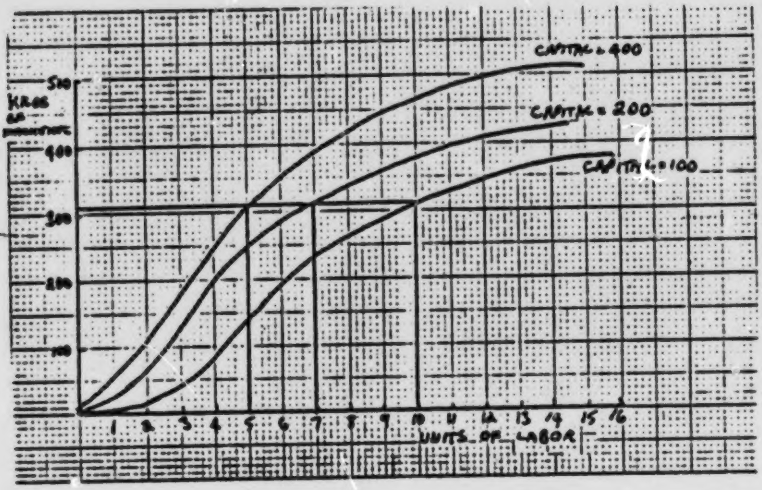


Note that the productivity curves associated with the higher amounts of fixed factor may join the original production frontier at lower levels of output (3.4.3) and for smaller quantities of labor hired. In subsequent diagrams it will be assumed that the curves remain distinct back to the origin.

3.7.3 Since, in the long run, a firm can vary the amounts it hires of both capital and labor, there will be an infinite number of possible combinations of units of capital and labor capable of producing a given level of output. Consequently, there will be an infinite number of different costs associated with a given level of output. These costs will be determined by the number of units of capital employed and the price of a unit of capital, together with the number of units of labor employed for each production frontier together with the price per unit of labour.

Example. The fishing boat firm could produce 310 kilos of mackerel by hiring different amounts of labor in conjunction with the different numbers of boats, as shown in Diagram 3.7.3(1).

Diagram 3.7.3(1) Different Ways of Catching 310 Kilos of Mackerel



This would result in three different costs as shown in Table 3.7.3(1).

Table 3.7.3(1) Different Costs of Catching 310 Kilos of Mackerel

Fixed Cost	Labor	Cost per unit of labor	Labor Cost	Total Cost
100	10	100	1000	1100
200	7	100	700	900
300	5	100	500	800

Note: these costs presume that, at each scale of operations, the firm is operating on the production frontier. If this were not the case, then even higher fixed inputs could be associated with the same number of units of labor to give 310 kilos of mackerel.

3.7.4 For any given level of output there will be a unique combination of capital and labor which will yield minimum costs. The minimum costs will be comprised of fixed costs + variable costs. For any other level of output minimum costs will again be comprised of fixed costs + variable costs but for no two levels of output will the same fixed cost yield minimum cost, i.e. the amount of fixed capital which yields minimum cost for one level of output will not yield minimum costs for any other level of output.

Example/

Note: complete divisibility of the fixed factor is assumed. Were capital indivisible, i.e. it could only be varied by relatively large amounts, "level of output" would require to be substituted by "range of output".

Example. In Table 3.7.3 it was shown that the minimum cost method of catching 310 kilos of mackerel was to use the largest amount of capital of the three methods available, and 5 units of labor. However, to catch 264 kilos the costs shown in Table 3.7.4 would be incurred:

Table 3.7.4 Different Costs of Catching 264 Kilos of Mackerel

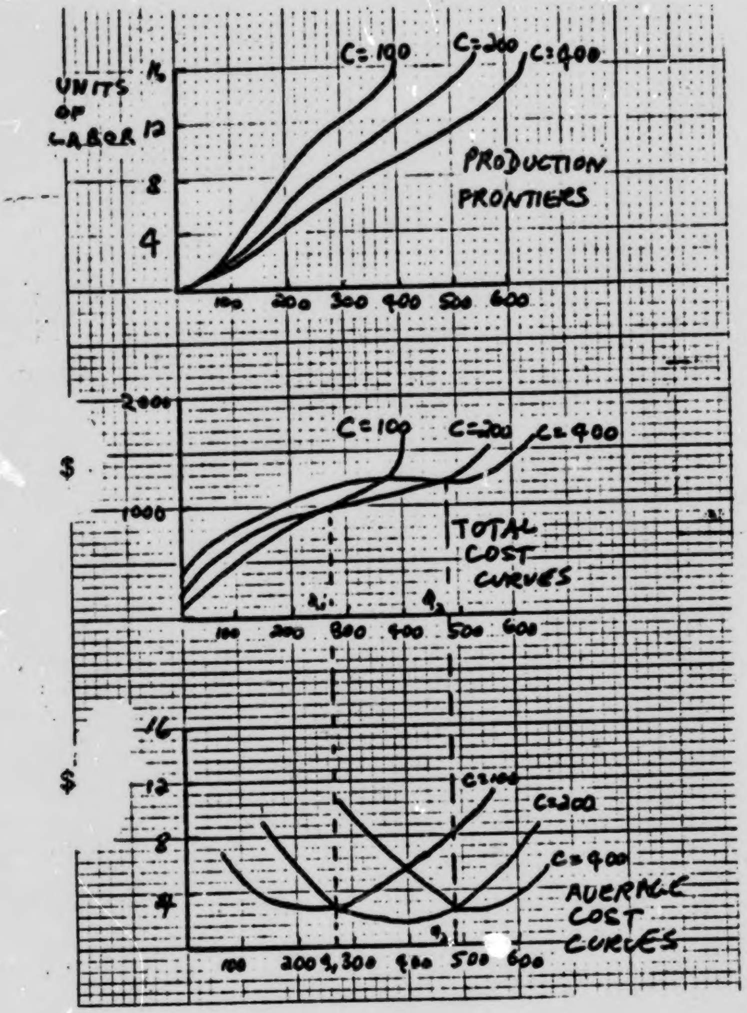
Fixed Cost	Units of labor	Cost per unit of labor	Labor Cost	Total Cost
100	8	$ 100	800	900
200	5	$ 100	500	700
400	4	$ 100	400	800

The highest fixed cost input, i.e. using three boats, is no longer the least cost method of catching mackerel. Hence the owner of the fishing boat firm must have some expectation of how much can be sold prior to deciding on the size of the fixed factor of production.

3.7.5 The long run average cost schedule (curve) for a firm will be the schedule (curve) of minimum average total costs associated with each level of output, i.e. it will be composed of points on short run average cost curves. For any output level no point on a short run average cost curve can lie below the point on the long run average cost curve. The long run average cost curve, often called the envelope curve, is assumed to be U shaped, i.e. to follow the same general pattern as the short run average cost curves.

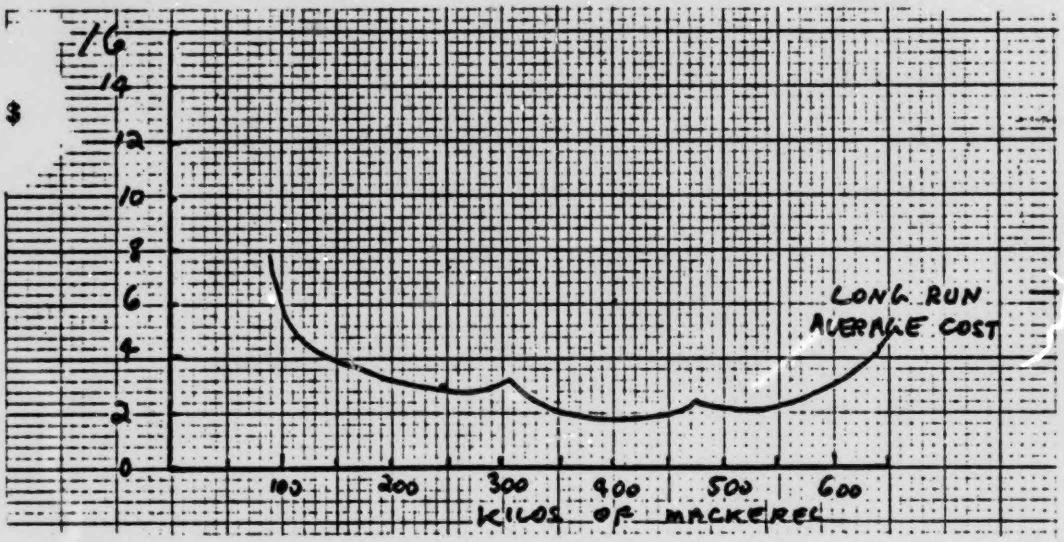
Example. Diagram 3.7.5(1) shows the production frontiers, total cost and average cost curves for the three sizes of fishing boat firm, illustrating that there are ranges of output within which one level of capital input results in lower costs than the other levels of capital input.

Diagram 3.7.5(1) Cost Curves for Different Capital Inputs



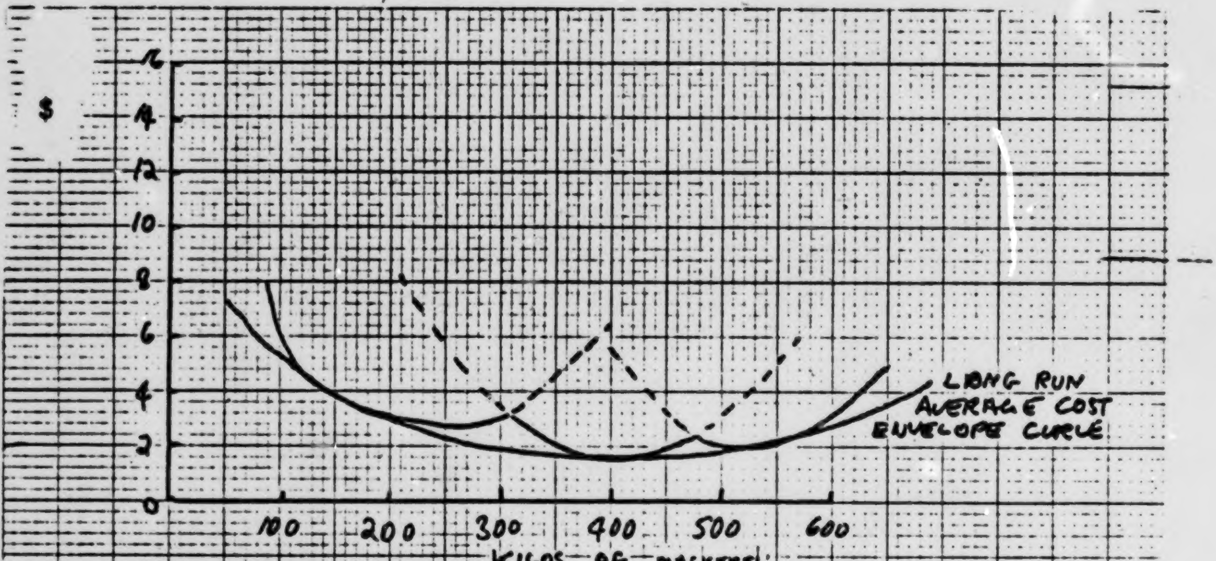
The lowest portion of each short run average cost curve comprises the long run average cost curve as shown in Diagram 3.7.5(2).

Diagram 3.7.5(2) The Long Run Average Cost of Catching Mackerel



If the size of the fishing boat could be varied by infinitesimally small amounts a smooth envelope curve could be drawn which was comprised of the lowest points of a large number of such short run average cost curves and which would have the following form:

Diagram 3.7.5(3) The Envelope Curve: the Long Run Average Cost of Catching Mackerel



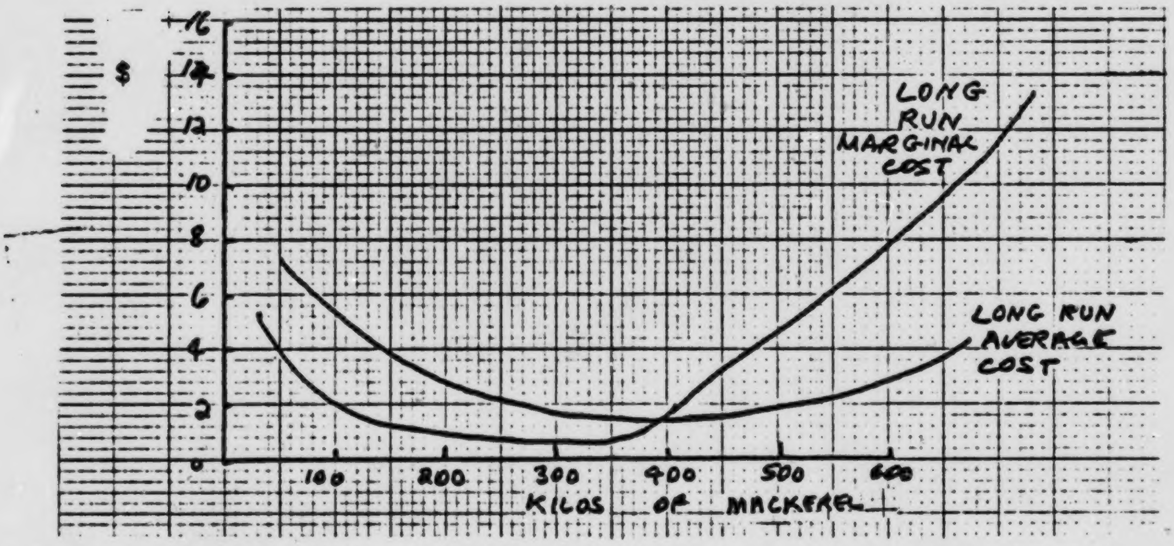
In the diagram is included the three short run average cost curves of Diagram 3.7.5(2), and each of these touches the envelope curve at one point only, i.e. if capital is divisible the long run average cost curve is smooth.

3.7.6 The long run marginal cost is the cost of producing an additional unit of output when all factor inputs are variable. The properties of the firm's long run marginal cost curve are comparable to the firm's short run marginal cost curve.

SRMC	LRMC
dC/dQ (capital fixed)	dC/dQ (no factor fixed)
passes through minimum of AVC, ATC	passes through minimum of LAC
is firm's short run supply curve	is firm's long run supply curve

Example. Diagram 3.7.6(1) contains the long run average cost curve shown in Diagram 3.7.5(3) together with the long run marginal cost curve of the firm.

Diagram 3.7.6(1) Long Run Marginal Cost



3.7.7 The firm will maximize profits in the long run by producing up to the point at which the additional revenue from selling one additional unit of output just equals the additional costs incurred in producing that unit. Since the additional revenue from selling an additional unit equals the price of that unit and additional costs equal LRMC, the profit maximizing rule is:

P = LRMC

Profit maximization in the short run requires that:

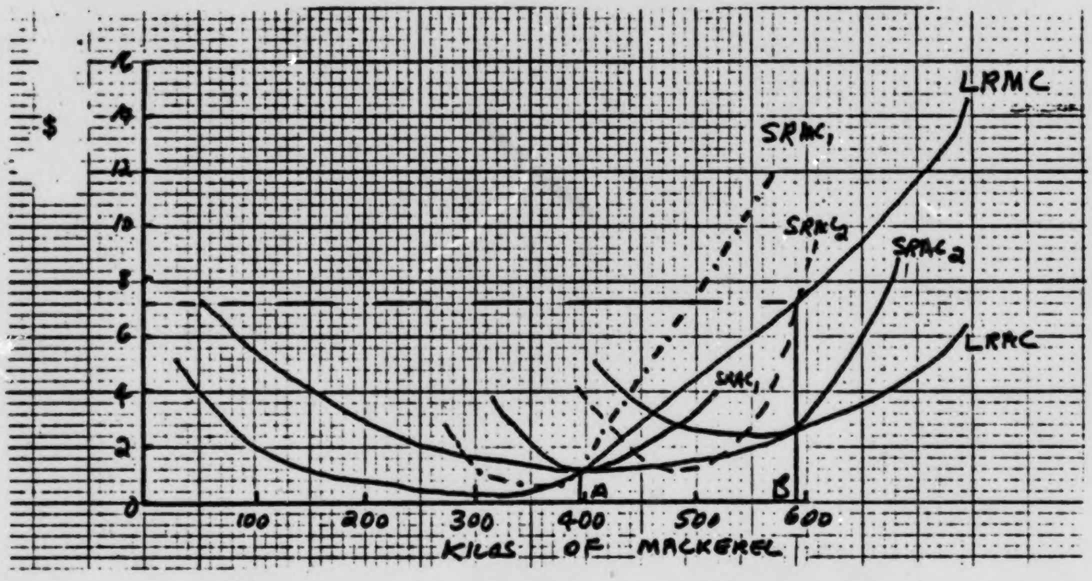
P = SRMC

therefore for the firm to be in long run equilibrium

P = LRMC = SRMC

Example. Diagram 3.7.7(1) combines Diagram 3.7.6(1) and Diagram 3.7.5(3) to show the long run equilibrium of the firm at a price of $5 per kilo of mackerel.

Diagram 3.7.7(1) **The Long Run Equilibrium of the Firm**



The $SRMC_1$ and LRMC are equal at the lowest level of LRAC, which is also the point of equality with $SRAC_1$. At $5 the long run supply curve indicates an output of OB, and at this output LRMC = $SRMC_2$, and LRAC = $LRAC_2$. Thus at a price of $5 per kilo, the profit maximizing fishing firm will use capital = $400 and produce OB kilos of mackerel.

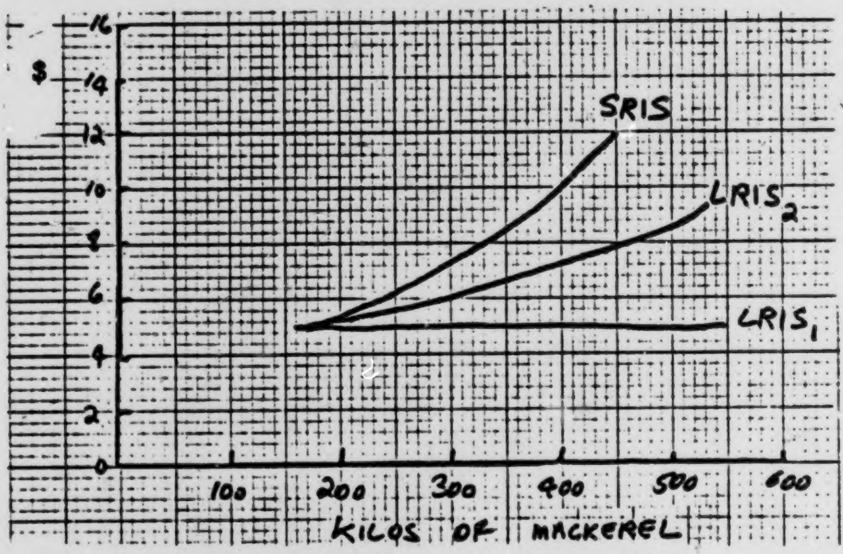
3.8 Industry Supply in the Long Run

3.8.1 While the short run industry supply curve of an industry is obtained by summing the short run supply curves of the individual firms within that industry (3.6.1), the long run supply curve of the industry cannot be found by summing the long run supply curves of the individual firms in the industry. This is because in the long run firms will move into or out of the industry. If costs rise as firms enter the industry the LR industry supply curve will rise; if costs are unaffected by firms entering the industry the long run industry supply curve will be a horizontal line.

Example. If Captain Harry were to order an additional two fishing boats there would be no discernible effect on the costs of building fishing boats. However, if the whole Pacific coast mackerel fleet decided to double in size there would be a considerable effect on costs in the fishing boat building industry.

Diagram 3.8.1(1) shows the possible shapes of the long run industry supply curve of mackerel compared to the short run industry supply curve (3.6.1).

Diagram 3.8.1(1) The Long Run Industry Supply Curve for Mackerel



LRIS$_1$ shows that in the long run there will be an unlimited supply at the price of \$5. If the effect of new firms entering the industry were to increase costs a long run supply such as LRIS$_2$ would result.

3.9 Characteristics of Supply

3.9.1 The shape of the total product of the variable factor input curve determines the shape of the short run TC and SRAC curves but does not determine the shape of the long run AC or LRMC curves.

The concept of increasing, constant and diminishing returns refers to the change in output resulting from changes in the variable factor only:

increasing returns occur when $\Delta Q/Q > \Delta L/L$

constant returns occur when $\Delta Q/Q = \Delta L/L$

diminishing returns occur when $\Delta Q/Q < \Delta L/L$

Returns to scale refer to the change in output resulting from changes in all factors of production:

increasing returns to scale occur when $\Delta Q/Q > \frac{\Delta (L,C)}{(L,C)}$

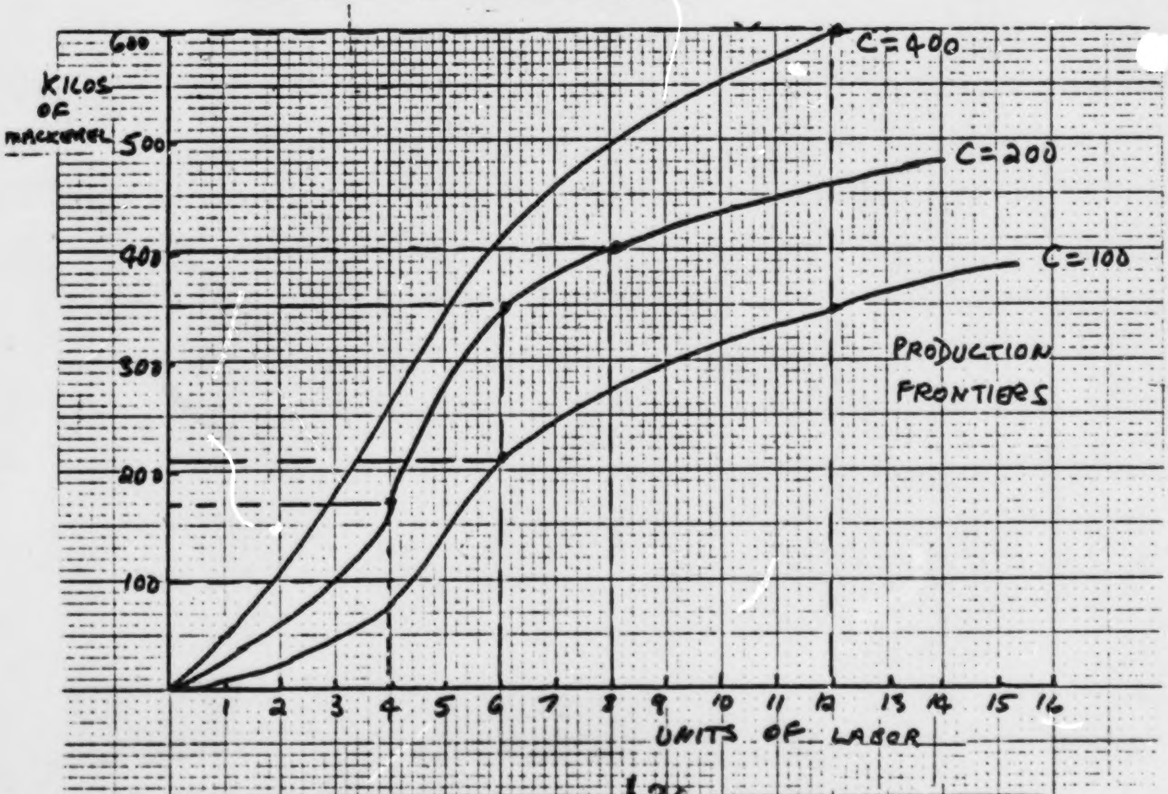
constant returns to scale occur when $\Delta Q/Q = \frac{(L,C)}{(L,C)}$

diminishing returns to scale occur when $\Delta Q/Q < \frac{\Delta (L,C)}{(L,C)}$

Note: no relationship exists between returns to factors of production and returns to scale.

Example. In Diagram 3.9.1(1) the production frontiers for the three levels of capital input are shown together with the effects of varying the labor input on its own and both inputs together.

Diagram 3.9.1(1) Increasing Constant and Diminishing Returns Together with Returns to Scale



With a capital input of $100, a doubling of the labour (variable factor input) from 6 to 12 (i.e. a 100% increase) results in an increase in output from 210 to 348 kilos of mackerel (an increase of 66%); thus over this range of output there are diminishing returns to the variable factor. With a fixed factor input of $200 a doubling of the variable factor input from 4 units of labor to 8 units of labor increases the output from 160 kilos to 400 kilos, an increase of 150% over this range of output, i.e. increasing factor returns.

A doubling of both factor inputs from capital input = $100 to $200 and labor input 4 to 8 units increases output from 80 to 400 kilos, i.e. there is increasing returns to scale. A doubling of the inputs from capital = $200 and labor = 6 to capital = $400 and labor = 12 results in an increase in output from 350 to 600 kilos, i.e. there are diminishing returns to scale.

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3.9.2 In the short run firms in the industry will adjust their output as price changes according to their individual supply curves (3.5.6). These price changes will lead to a movement along the industry supply curve (3.6.1).

In the long run firms within the industry will change both fixed and variable inputs as price changes to achieve long run equilibrium (3.7.7) and firms will enter or leave the industry resulting in a movement along the long run industry supply curve (3.8.1).

It is useful to have a measure of the responsiveness of quantity of output supplied to change in price; elasticity of supply is defined as: $\frac{Q}{Q} \quad \frac{P}{P}$. This measure is subject to the same qualifications as the measure of elasticity of demand (2.7). Two cases are distinguished: elastic and inelastic supply.

3.9.2.1 Elastic supply: when a proportionate increase (decrease) in price produces a more than proportionate increase (decrease) in supply.

Example. In the fishing industry example of 3.6.1, at low levels of output a relatively small increase in the price of fish will result in a more than proportional increase in the quantity of fish caught since with the fixed factors it is possible to hire additional units of labor whose marginal product is relatively high.

3.9.2.2 Inelastic supply: when a proportionate increase (decrease) in price produces a less than proportionate increase (decrease) in supply.

Example. At higher levels of output in the fishing example, an increase in the price of mackerel will have a proportionately smaller effect on the amount of fish caught because the smaller boats will be unable to increase output in the short run no matter if additional units of labor are hired.

3.9.3 The long run elasticity of supply will normally be greater than the short run elasticity of supply because firms in the industry are able to increase or reduce their use of fixed factors or move out of or into the industry in response to price changes.

Example. In Diagram 3.8.1(1) the LRIS curve was drawn between the SRIS curve and the horizontal $LRIS_1$ curve, i.e., a supply curve of infinite elasticity. Because of the effect on industry supply of firms moving in and out of the industry it is not possible to estimate the long run elasticity of supply from the information available on the firms currently in the industry.

MICRO UNIT 4

PRICE AND OUTPUT DETERMINATION IN MARKETS

4.1 The Concept of a Market
4.2 Market Supply and Demand
4.3 The Operation of Markets
4.4 Changes in Market Equilibrium
4.5 Intervention in the Market
4.6 Dynamic Adjustments in the Market

4.1 The Concept of a Market

4.1.1 A market is formed when individuals with demands for a good, i.e. potential buyers, are in communication with individuals willing to supply that good, i.e. potential sellers.

> *Example. There is a market for Rose Bowl tickets even after they have all been allocated, if some students are prepared to buy tickets for the football game and other individuals who possess tickets are willing to sell them.*

4.1.2 The geographical dimensions of markets vary considerably. Markets may be highly localized (the limiting case being one potential buyer and one potential seller) or they may be international, involving buyers and sellers in different countries.

> *Example. There is a market for houses and apartments in each small town in Mississippi and in each large city in California. Each of these is a local market. In contrast, many basic materials and commodities such as coffee, cocoa, sugar, shipping, copper, zinc and steel are bought and sold internationally by dealers from many countries.*

4.1.3 Markets exist not only for goods and services but also for resources.

> *Example. In the U.S. there is a market for computer programmers which consists of all those people with qualifications and/or experience in programming who wish to be employed as programmers, and all those organizations, e.g. universities, corporations, banks, etc., which wish to hire computer programmers.*

4.1.4 In a market in which exchange takes place, the competition among buyers (explicit or implicit) to buy a good and the competition among sellers (explicit or implicit) to sell that good produces a price (prices) for the good, at which quantities of the good are bought and sold.

> *Example. In the annual Scottish Highland Show cattle dealers from many countries come together to bid against each other in the market to purchase top Aberdeen Angus bulls. Scottish farmers compete with each other to sell those bulls. It is the competition among buyers and also among sellers which determines both the price of Aberdeen Angus bulls and the quantity bought and sold. Because the buyers and sellers are in direct communication with each other the competition is explicit. But in a similar way implicit competition exists among/*

among suppliers of automobiles offered for sale through major dealers and implicit competition also exists among individuals who wish to buy automobiles. A potential buyer of a Ford Mustang may not come into contact with other potential buyers but nevertheless competition exists between them. Similarly, two large Ford dealers on opposite sides of a major city may not directly observe each other's behavior in the same way as do potential sellers at the Highland Show but they still compete with each other to sell Ford Mustangs to potential buyers.

4.1.5 Market prices provide information to buyers attempting to maximize utility from the allocation of their budgets on a variety of goods and services, and also to suppliers attempting to maximize profits from the production and sale of a variety of goods and services.

Example. In the Scottish Highland Show each individual cattle dealer knows what price he is prepared to pay for Aberdeen Angus bulls (i.e. his demand schedule) but it is the market which provides information about the prices at which exchange actually takes place. Similarly, while each farmer knows the price at which he would be willing to sell bulls (i.e. his supply schedule) it is the market which indicates to all farmers the prices at which exchange actually takes place.

4.1.6 While the decisions of suppliers determine which resources are employed and consequently which goods and services are produced and also how much of each good and service is produced, economic efficiency requires that resources are allocated to the production of those goods and services which satisfy society's wants as fully as possible. Prices indicate to suppliers society's preferences for different goods and services, and it is to prices that suppliers respond in the decision making process. Consequently prices determine how resources are allocated.

Example. Following the Middle East crisis in the early 1970s, significant rises in the price of oil relative to other goods changed the pattern of resource allocation in the automobile industry. Journeys by private automobile became relatively more expensive than other forms of transport, and potential new car buyers' tastes moved in favor of smaller cars with lower gasoline consumption. As a result, automobile firms changed production plans to increase the output of compact cars, and in turn this led to changes in the quantity of labor and also the amount and type of capital equipment used in automobile production as these firms, seeking to maximize profits, geared their assembly lines towards producing compact cars.

4.1.7 In a market economy a system of interrelated markets for goods, services/

services and resources determines how resources are allocated and operates without any centralized planning mechanism or central decision making body.

> *Example. In the U.S., millions of households buy quantities of food and drink every day, including bread, cheese, meat, milk, coffee, cans of fruit, fresh fruit, butter, margarine, fish, etc. Retail outlets of every size, from small corner grocery stores to giant supermarkets, regularly estimate how much of each kind of food and drink they will sell, and in turn place orders with suppliers. These suppliers base production plans for food and drink on the basis of estimated consumer demand and therefore allocate resources to the supply of various kinds of food and drink accordingly.*
>
> *The relative quantities of food and drink bought by households are not decided by some central plan, nor are the resources allocated to the production of food and drink decided by a planning mechanism. Instead the pattern of resource allocation is the outcome of millions of independent households expressing their preferences for various kinds of food and drink in markets, and the decisions of many independent suppliers to hire resources in order to satisfy consumer preferences by producing the goods they desire.*

4.2 Market Supply and Demand

4.2.1 A market demand curve relates the quantities of a good individuals would be prepared to buy at different prices; a market supply curve relates the quantities of a good supplies would be prepared to sell at different prices. A necessary condition for exchange to take place in a market is that there must be at least one common price at which suppliers would be prepared to sell a quantity of the good and at which individuals would be prepared to buy a quantity of the good.

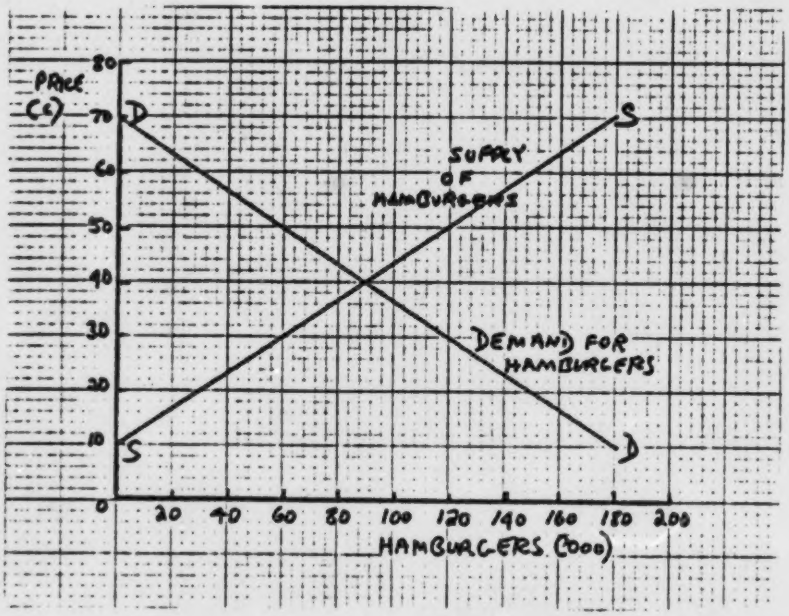
Example. Table 4.2.1(1) contains data relating to hypothetical demand and supply schedules for hamburgers in a U.S. city.

Table 4.2.1(1) Market Demand and Supply Schedules for Hamburgers in a U.S. city

Price	Quantity Demanded ('000 per week)	Quantity Supplied ('000 per week)
10c	180	0
20c	150	30
30c	120	60
40c	90	90
50c	60	120
60c	30	150
70c	0	180

These data are expressed diagrammatically in Diagram 4.2.1(1).

Diagram 4.2.1(1) Market Demand and Supply Curves for Hamburgers in a US City



Exchange could take place in this market at any price above 10c. and below 70c. This is because at least one consumer would be prepared to buy a hamburger and at least one supplier would be prepared to sell a hamburger at all prices within this range. Exchange would be possible at a price of 60c., for example, since consumers would be prepared to buy 30,000 hamburgers per week and firms would be willing to supply 150,000 hamburgers per week. At a price of 20c. exchange would also be possible since consumers would be willing to BUY *150,000 hamburgers per week and suppliers would be willing to sell 30,000 hamburgers per week at that price. It would not be possible, however, for exchange to take place at 10c., because although individuals would be willing to buy 180,000 hamburgers per week at that price, no firms would be prepared to supply hamburgers at 10c. each. Similarly, exchange could not take place at 70c. because no individuals would be willing to buy hamburgers at that price, although firms would be prepared to supply 180,000 hamburgers per week at that price.*

4.2.2 The reason that exchange takes place in a market is that both buyers and sellers benefit. Assuming rational behavior, any consumer who is prepared to buy a unit of a good at a certain price must prefer that good to cash, otherwise there would be no incentive for him to sacrifice cash in order to acquire the good. Similarly, any producer who is prepared to supply a unit of a good at a certain price must prefer cash to the good, otherwise there would be no incentive for him to participate in exchange.

Example. In the market for hamburgers illustrated in 4.2.1, consumers would be prepared to buy 120,000 hamburgers at a price of 30c., and at that price producers would be willing to supply 60,000 hamburgers. Both consumers and producers would gain through exchange. Consumers who wish to buy hamburgers at 30c. would gain more satisfaction from a hamburger than from 30c. Producers who would be prepared to sell hamburgers at 30c. would prefer the 30c. received from the sale of each hamburger to the hamburgers themselves.

4.2.3 Even where a market demand schedule for, and a market supply schedule of a good exist, exchange would be impossible if there were no common price at which at least one consumer was prepared to buy a unit of the good and at least one producer was willing to supply a unit of the good.

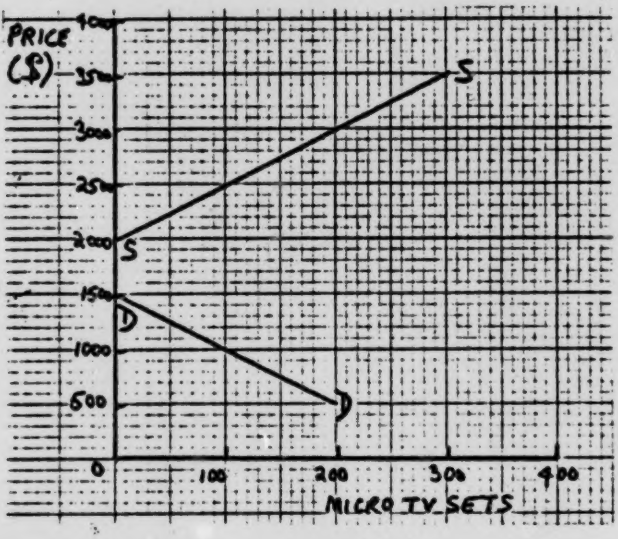
Example. Suppose the electronics industry developed a new micro-television set with a one inch square screen to be worn on the wrist, and suppose that the market demand and supply schedules are as shown in Table 4.2.3(1).

Table 4.2.3(1) Market Demand and Supply Schedules for Micro TV Sets

Price ($)	Quantity Demanded (per week)	Quantity Supplied (per week)
500	200	0
1000	100	0
1500	0	0
2000	0	0
2500	0	100
3000	0	200
3500	0	300

Exchange would not be possible in this market because there is no common price at which consumers and producers would be prepared to buy and sell the micro TV sets. Consumers would be willing to buy certain quantities of these sets at prices of $1000 and below. In contrast, producers would only be prepared to supply the TV sets at prices of $2500 and above. As shown in Diagram 4.2.3(1) there is no price at which exchange would occur.

Diagram 4.2.3(1) Market Demand and Supply Curves for Micro TV Sets

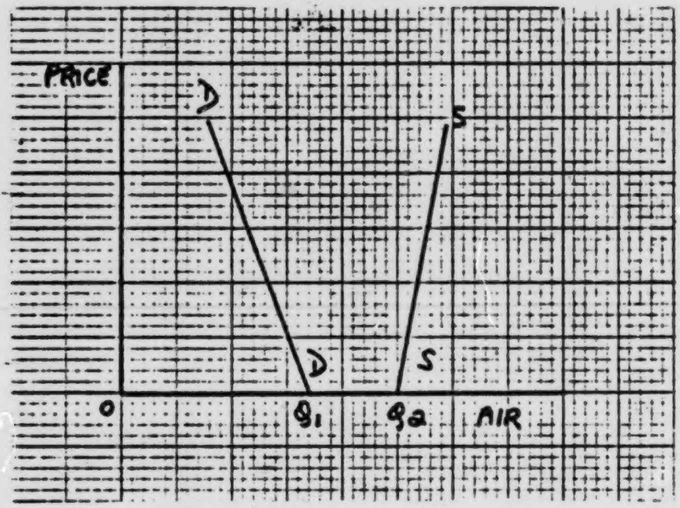


4.2.4 If at all positive prices in a market the quantity of a good supplied exceeds the quantity demanded, the price of the good will be zero. When such market circumstances occur, the good is referred to as a "free" good.

Example. Goods such as fresh air are often classified as free goods when consumers can have as much of them as they want/

want without having to pay for them. As shown in Diagram 4.2.4(1) the market for air in the Scottish Highlands may be represented by the supply curve SS, and the demand curve by DD.

Diagram 4.2.4(1) **Demand for and Supply of Air in the Scottish Highlands**



The supply curve slopes upwards because at various positive prices, individuals would be prepared to supply different quantities of air, e.g. in the form of air conditioning.

The quantity of air available at a price of zero is OQ_2. The largest quantity of air people desire is OQ_1 at a price of zero. Thus at a price of zero the quantity supplied exceeds the quantity demanded.

Given these demand and supply schedules, a zero price for air would exist in the market because, at that price, people can have as much air as they want. Goods, however, such as air and water, which are traditionally regarded as free, may have particular markets in which exchange at a positive price can take place. In Los Angeles, for example, fresh air is not always a free good but it can be available through air conditioning. The market for air conditioning would be represented by a diagram similar to the hamburger market diagram of 4.2.1. As shown in Diagram 4.2.4(2) consumers would be willing to buy different quantities of air conditioning systems at different prices and in which producers would be prepared to supply different quantities of air conditioning systems at different prices. In the air conditioning market there would be a range of prices at which exchange could take place.

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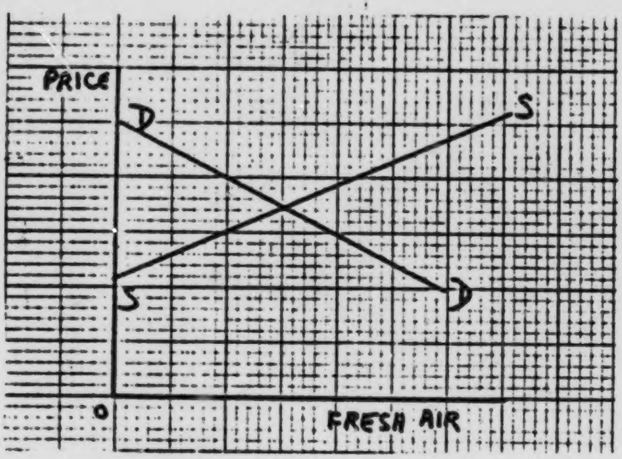
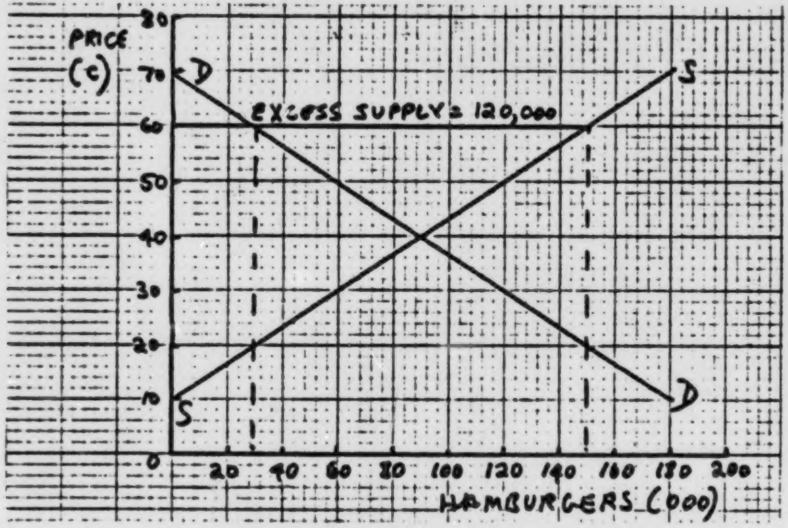
Diagram 4.2.4(2) Market Demand and Supply Curves for Air Conditioning



4.2.5 **Excess supply exists in a market when, at a given price, the quantity of a good firms are prepared to supply exceeds the quantity consumers are prepared to buy.**

Example. Diagram 4.2.5(1) illustrates a situation of excess supply in the market for hamburgers.

Diagram 4.2.5(1) Excess Supply in a Market

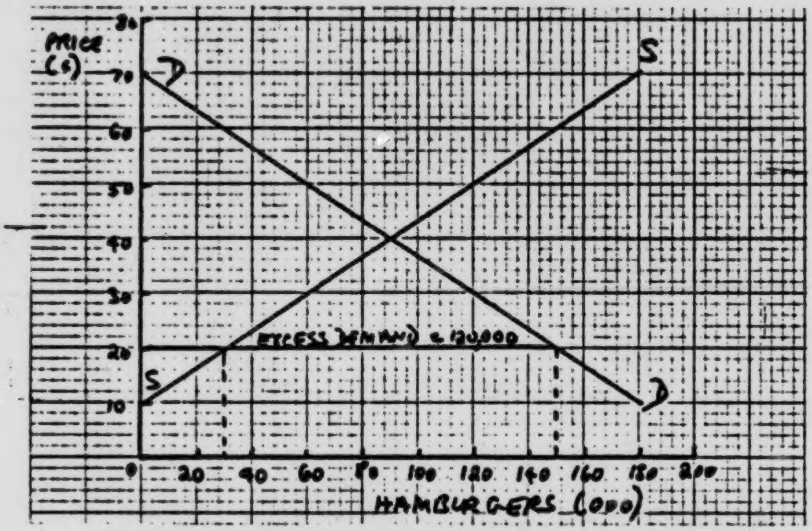


At a price of 60c. hamburger suppliers would be willing to sell 150,000 hamburgers per week whereas consumers would be willing to buy only 30,000 hamburgers per week. Therefore at a price of 60c. excess supply of 120,000 hamburgers per week would exist.

4.2.6 Excess demand exists in a market when, at a given price, the quantity of a good consumers are prepared to buy exceeds the quantity firms are prepared to supply.

Example. Diagram 4.2.6(1) illustrates a situation of excess demand in the market for hamburgers.

Diagram 4.2.6(1) Excess Demand in a Market

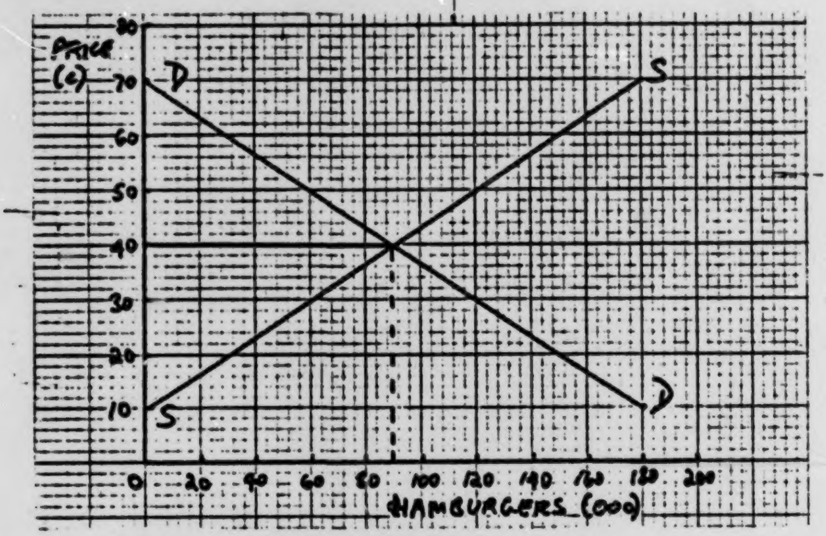


At a price of 20c. consumers would wish to buy 150,000 hamburgers per week, but suppliers would be willing to sell only 30,000 hamburgers per week at that price. Hence excess demand of 120,000 hamburgers per week would exist if the price were 30c.

4.2.7 At the unique price in a market at which the quantity of a good consumers are willing to buy equals the quantity of the good firms are willing to sell, neither excess demand nor excess supply exists. All individuals who are willing to buy as much of the good as they want at that price are able to do so, and all firms who are willing to sell as much of the good as they wish at that price are able to do so.

Example. Diagram 4.2.7(1) illustrates the price in the market for hamburgers at which neither excess demand nor excess supply exists.

Diagram 4.2.7(1) Hamburger Market with Neither Excess Demand nor Supply



At a price of 40c., consumers would be prepared to buy 90,000 hamburgers per week and suppliers would be willing to sell exactly the same quantity. Every individual hamburger producer who is willing to supply hamburgers at 40c. each would be able to sell them to consumers, and every individual wishing to buy hamburgers at 40c. each would be able to do so.

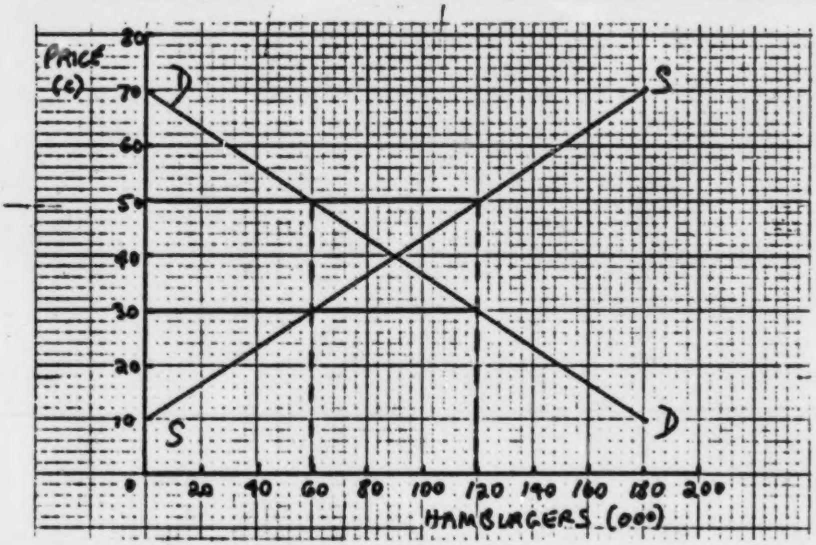
4.3 The Operation of Markets

4.3.1 If a price causes excess demand or excess supply to exist in a market, forces in the market will change the price of the good and the quantity bought and sold. These forces will eventually eliminate any excess demand or excess supply.

4.3.1.1 If at a given price excess supply were to exist in a market, competition among suppliers would force down the price of the good. Simultaneously, at lower prices a larger quantity of the good will be demanded. Thus at lower prices the excess supply will be reduced. Eventually a price would be reached at which excess supply will be zero.

Example. Diagram 4.3.1(1) again illustrates the market for hamburgers in a U.S. city.

Diagram 4.3.1(1) The Market for Hamburgers in a U.S. City



It is possible for at least one hamburger to be offered for sale and to be demanded at any price above 10c. and below 70c. This is because at least one supplier is prepared to sell a hamburger for at least 10c. while at least one buyer is prepared to pay up to 70c. for a hamburger. If one buyer and one seller agreed to terms of exchange within this price range and if the terms of exchange were known to all other potential buyers and sellers in the market, they would act on the information provided.

If one hamburger were sold to a consumer for 50c. and as a result all suppliers attempted to sell hamburgers for 50c. each, some/

some suppliers would discover that they could not find customers at that price. This is because (as shown in 4.2.3) excess supply would exist at 50c. since 60,000 more hamburgers would be offered for sale than consumers would wish to buy.

Some suppliers who could not find individuals wishing to buy hamburgers at 50c. would be willing to lower their asking price below 50c., because the supply curve indicates that some suppliers would be prepared to sell hamburgers at prices less than 50c. But this act of lowering the price would provide information to all other buyers and sellers in the market.

Buyers who are prepared to pay 50c. or more for a hamburger will seek those suppliers offering hamburgers for sale at less than 50c. Additionally, at lower prices some consumers will buy more hamburgers. Others who would not buy at the higher prices will now be prepared to purchase hamburgers..

At 40c. each, the quantity consumers would be prepared to buy is 90,000 per week, and this exactly equals the quantity that firms would be prepared to supply. The excess supply which originally existed at 50c. would therefore be eliminated.

4.3.1.2 If at a given price excess demand were to exist in a market, competition between consumers would force up the price of a good. Simultaneously, at higher prices, suppliers would be willing to sell a greater quantity of the good. Thus at higher prices excess demand would be reduced. Eventually a price will be reached at which excess demand will be zero.

Example. If the original exchange between one buyer and seller in the market for hamburgers were agreed at 30c., and as a result all sellers decided to ask for a price of 30c. each for hamburgers, some potential buyers would find it impossible to obtain hamburgers. This is because, as shown again in Diagram 4.3.1.1, excess demand would exist at a price of 30c. since 60,000 more hamburgers would be desired by consumers than firms would be prepared to supply. Those individuals who could not obtain hamburgers would be willing to bid up the price of hamburgers because, as indicated by the demand curve, some consumers would be prepared to pay prices above 30c. to obtain hamburgers. But those individuals who pay more than 30c. each for hamburgers would provide information to all other buyers and sellers in the market.

Suppliers who are prepared to sell hamburgers for 30c. or less will seek those consumers who are prepared to pay more than 30c. to obtain hamburgers. Additionally, at higher prices some suppliers will sell more hamburgers. Other suppliers who would/

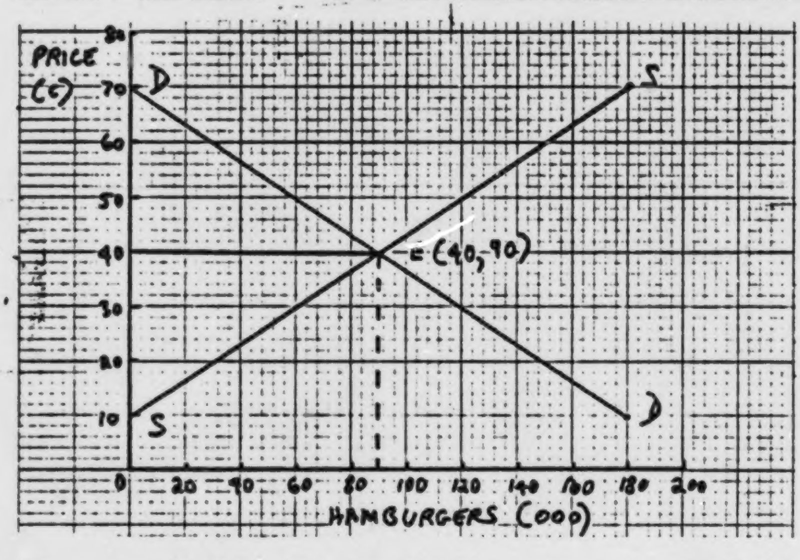
would not sell hamburgers at lower prices will now be prepared to sell hamburgers.

At 40c. each the quantity consumers in total would be prepared to buy would exactly equal the quantity firms would be willing to supply, i.e. 90,000 per week. The excess demand which originally existed at 30c. would therefore be eliminated.

4.3.2 When the forces which act to eliminate excess demand or excess supply exactly offset each other, a market is defined as being in equilibrium. The price at which equilibrium occurs in a market is the price which allows all individuals who wish to buy a good to obtain as much as they wish at that price, and enables all producers who wish to sell the good to sell as much as they wish at that price. The price at which the intentions of all potential buyers and sellers are exactly matched is called the equilibrium price, and the identical quantity of the good which the two sides wish to buy and sell at that price is called the equilibrium quantity.

Example. In Diagram 4.3.2(1) the equilibrium price of hamburgers in this market is 40c., since all buyers who wish to purchase hamburgers at 40c. each are able to do so and all firms who wish to sell hamburgers at 40c. each are able to find buyers.

Diagram 4.3.2(1) Equilibrium Price and Quantity in a Market



Diagrammatically, the equilibrium price is established where the demand and supply curves intersect, i.e. at point E. At the price of 40c. the market is just cleared since both excess demand and excess supply are zero. The quantity bought and sold at 40c. is 90,000 per week and there are no unsatisfied buyers/

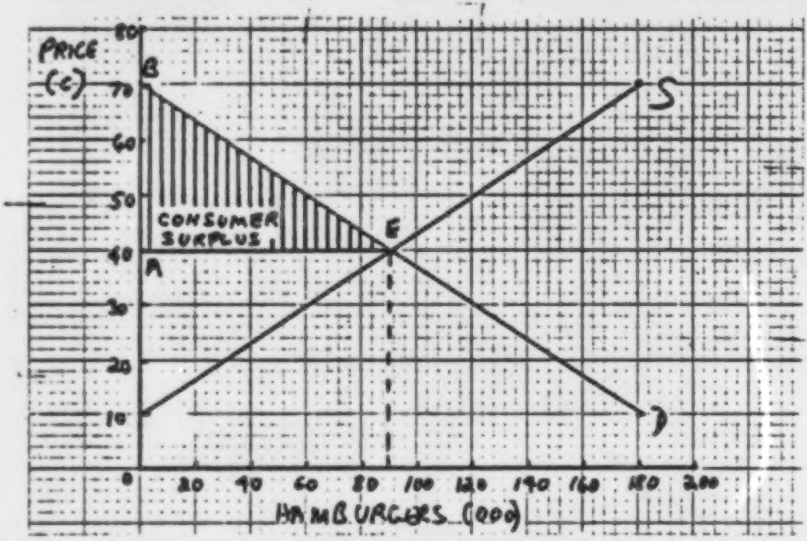
buyers or sellers. In this market 90,000 hamburgers per week is the equilibrium quantity.

4.3.3 When exchange takes place in a market, gains accrue to both consumers and producers. If such gains did not exist there would be no incentive for exchange to take place.

4.3.3.1 A demand curve relates the quantities of a good individuals would buy at different prices, and it also relates the maximum prices which individuals would be willing to pay for different quantities of a good. However, if individuals can obtain units of a good at a price which is less than they would be prepared to pay, they would derive an additional gain from exchange. This additional gain is called consumer surplus, and can be measured by the difference between the price individuals actually pay for units of a good, and the higher prices they would be prepared to pay.

Example. Diagram 4.3.3.1(1) again illustrates the market for hamburgers in a U.S. city.

Diagram 4.3.3.1(1) Measurement of Consumer Surplus



The equilibrium price of hamburgers is 40c. and the equilibrium quantity is 90,000 per week. This means that a price of 40c. is paid by every individual for every hamburger bought. But according to the downward-sloping demand curve, some consumers would have been prepared to pay more for hamburgers.

For example, one individual would be prepared to pay up to 70c. for the first hamburger, but he has to pay only 40c. He has a consumer surplus of 30c. Similarly, for successive quantities up/

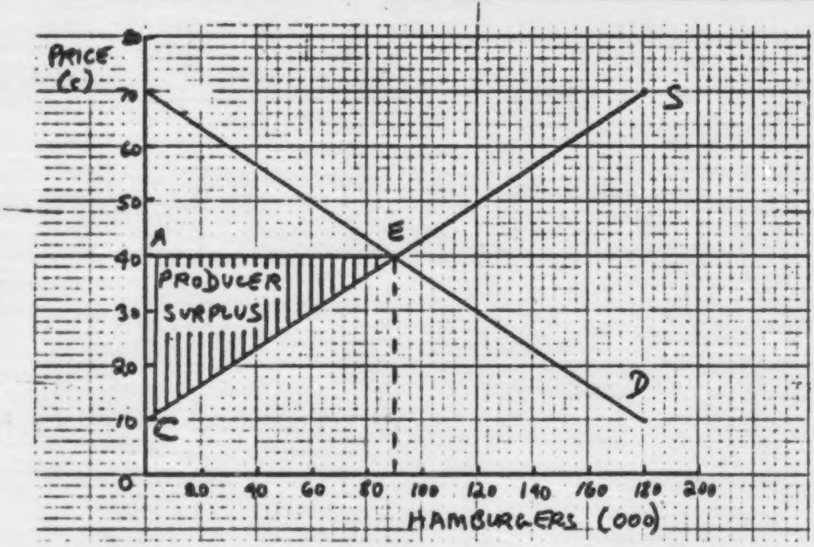
up to 90,000 per week there is a difference between the price of 40c. consumers pay for hamburgers and the price they would be willing to pay.

This difference is called consumer surplus and is illustrated graphically for each quantity of hamburgers by the vertical distance between the line AE (the price actually paid, i.e. 40c.) and the demand curve (the prices individuals would be willing to pay for different quantities). Hence for successive quantities of hamburgers up to 90,000 per week consumer surplus is denoted by a series of vertical lines between AE and the demand curve. At the equilibrium price of 40c. consumer surplus is measured by the shaded triangle BAE.

4.3.3.2 A supply curve relates the various quantities of a good suppliers would be prepared to sell at different prices, and it also relates the minimum prices at which suppliers would be prepared to sell different quantities of a good. If suppliers can sell units of a good at a price which is higher than they would be prepared to accept, they derive an additional gain from exchange. This additional gain is called producer surplus, and can be measured by the difference between the price suppliers actually receive for selling units of a good and the lower prices they would be prepared to accept.

Example 1. Diagram 4.3.3.2(1) illustrates how producer surplus is measured.

Diagram 4.3.3.2(1) Measurement of Producer Surplus



Assuming that the market is in equilibrium, a price of 40c. for hamburgers is received by every supplier for each of the 90,000 hamburgers sold. But the upward sloping supply curve indicates/

indicates that suppliers would be willing to sell hamburgers for prices less than 40c.

For example, one supplier would be prepared to sell a hamburger for just over 10c., but in fact receives 40c. He has a producer surplus of 30c. Similarly, for successive quantities of hamburgers up to 90,000 there is a difference between the price suppliers actually receive and the prices they would be prepared to accept.

This difference is called producer surplus and is illustrated graphically for each quantity of hamburgers by the vertical distance between the line AE (the price received by sellers for each hamburger, i.e. 40c.) and the supply curve (the prices suppliers would be prepared to accept for different quantities). Hence for successive quantities of hamburgers up to 90,000, producer surplus is denoted by a series of vertical lines between AE and the supply curve. At the equilibrium price of 40c. producer surplus is measured by the shaded triangle CAE.

Example 2. An example of how both consumer and producer surplus provide the motivating forces in a market to achieve equilibrium is provided by Myron Joseph's(1) *role-playing wheat game. This educational experiment is based on a hypothetical wheat market in which a typical class of economics students adopt the role of dealers, half of whom buy and the other half sell wheat.*

In the experiment a card is given by the instructor to each student requiring him to buy or sell 1000 bushels of wheat for not more or less than a certain price, as shown in Table 4.3.3.2(1).

Table 4.3.3.2(1) Distribution of Instruction Cards

Price ($)	Number of Buyers (not more than the price)	Number of Sellers (not less than the price)
2.80	4	-
2.60	4	2
2.40	4	2
2.20	4	2
2.00	4	2
1.80	4	4
1.60	2	4
1.40	2	6
1.20	2	6
1.00	2	4

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(1) "Role Playing in Teaching Economics" by Myron L. Joseph, in American Economic Review, Vol.LV, May 1965, Number 2.

Students are told that when the fictional market opens, they should adopt the role of dealers for clients and attempt to get the best they can in a transaction. Once the game commences students are free to contact each other to discuss terms of exchange. Each time an exchange is agreed, the instructor makes the price known to all students, and those students who have completed a deal may then pick up fresh cards and start again.

After a certain time the market is closed, and the whole class can then see the range of prices at which exchange actually took place, and the number of transactions which was recorded at each price. Table 4.3.3.2(2) shows the results from one experiment conducted by Joseph and which he presented at an annual meeting of the American Economics Association.

Table 4.3.3.2(2) Distribution of Transactions

Price ($)	Number of Transactions
2.60	1
2.50	0
2.40	1
2.30	0
2.20	6
2.10	1
2.00	15
1.90	25
1.80	27
1.70	20
1.60	16
1.50	13
1.40	5
1.30	1
1.20	3
1.10	1
1.00	1

According to Joseph, the initial exchanges were agreed at a wide range of prices. But then there was a tendency for prices to move towards a theoretical equilibrium level of $1.80. By the end of the game virtually every exchange was agreed at or close to $1.80.

This game illustrates the role of information in markets, since the disparity in prices soon disappeared once the terms of each exchange became known to all buyers and sellers. Any exchange at prices well above $1.80 (which would have enlarged the area of producer surplus if all deals were made at that price) resulted in fervent competition among sellers which in turn drove prices down. Conversely, any exchanges arranged at prices well below $1.80 (which would have extended the area of consumer surplus if all exchanges had taken place at that price) resulted in keen competition among buyers which in turn drove prices up.

4.4 Changes in Market Equilibrium

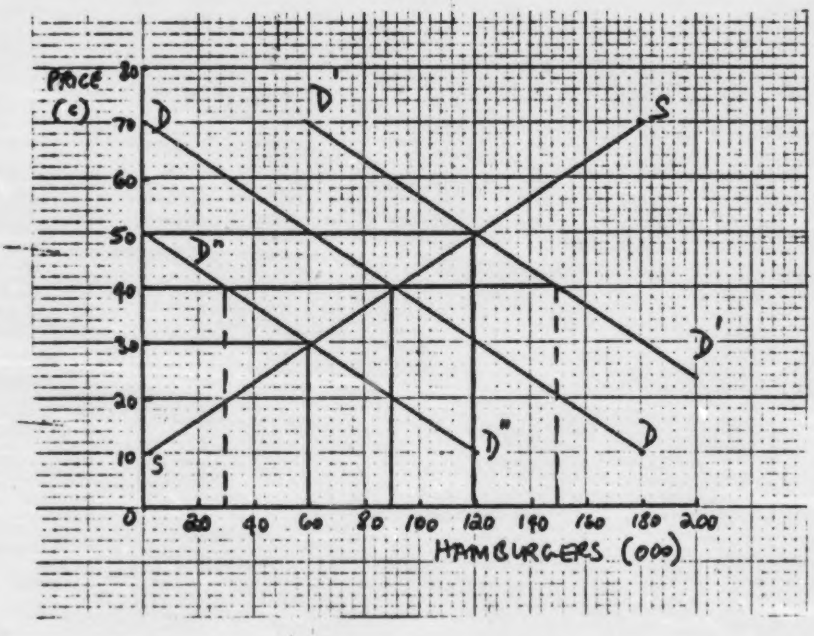
4.4.1 If a market were in equilibrium and if any of the conditions determining demand or supply were to change, forces would establish a different equilibrium price and/or a different equilibrium quantity.

4.4.1.1 Assuming that the supply conditions of a good remain unchanged, an increase in demand would lead to an increase in equilibrium price and an increase in equilibrium quantity, while a decrease in demand would lead to a decrease in equilibrium price and a decrease in equilibrium quantity.

Example. Diagram 4.4.1.1(1) illustrates again the market for hamburgers in a U.S. city, in which the original equilibrium price and quantity are 40c. and 90,000 per week. If the price of all other meat products were to rise and if this led to consumers substituting hamburgers for other meat, i.e. wishing to buy more hamburgers at every price, this would be defined as an increase in demand for hamburgers, and would be represented by a shift of the demand curve from DD to D'D'.

(N.B. There is a difference between an increase in demand and an increase in the quantity demanded. The former refers to a shift in the position of the whole curve caused by a change in a factor other than the price of the good in question. The latter refers to an increase in the quantity which would be demanded if the price were to be lower, other factors remaining unchanged, and is represented by a movement along a demand curve.)

Diagram 4.4.1.1(1) A Change in Demand with Supply Conditions Constant



Assuming no change in supply conditions, at the original equilibrium price of 40c. there would be excess demand for hamburgers given the demand curve in position D'D'. Suppliers would still wish to sell 90,000 hamburgers per week but consumers would be prepared to buy 150,000 hamburgers per week at a price of 40c.

For the reasons explained in 4.3.1.2 upward pressure would be exerted on price until a new equilibrium point were established at 50c., where D'D' intersects the supply curve. The new equilibrium price of 50c. and the new equilibrium quantity of 120,000 hamburgers per week would both be higher than the original equilibrium price and equilibrium quantity.

Conversely, if a health risk were to arise in connection with eating hamburgers, and if consumers wished to substitute other meat products for hamburgers and buy fewer hamburgers at every price, the decrease in demand for hamburgers would be represented by a shift of the demand curve from DD to D"D". At the original equilibrium price of 40c. there would be excess supply of 60,000 hamburgers per week, assuming supply conditions remained constant. Consumers would now wish to buy only 30,000 hamburgers per week whereas suppliers would be prepared to sell 90,000 per week.

For the reasons explained in 4.3.1.1 downward pressure would be exerted on price until a new equilibrium point were established at 30c., where D"D" intersects the supply curve. The new equlibrium price of 30c. and the new equilibrium quantity of 60,000 hamburgers per week would both be lower than the original equilibrium price and equilibrium quantity.

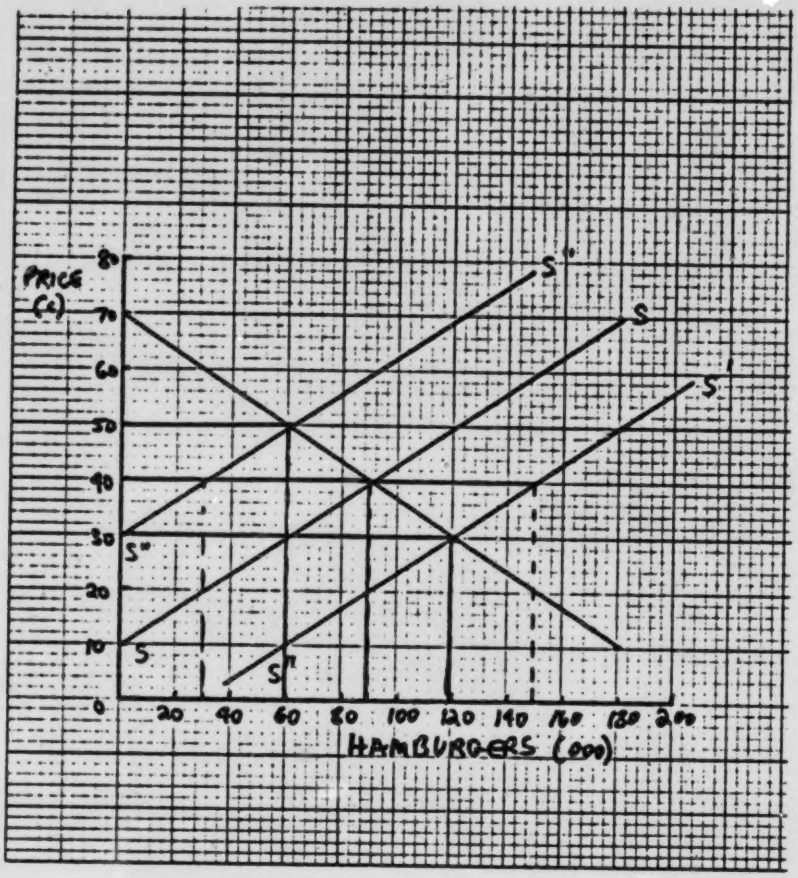
In each of the above examples the new equilibrium price and equilibrium quantity would be determined as a result of a shift in the demand curve and a movement along an unchanged supply curve.

4.4.1.2 Assuming that the demand conditions for a good remain unchanged, an increase in supply would lead to a fall in equilibrium price and an increase in equilibrium quantity, while a decrease in supply would lead to a rise in equilibrium price and a fall in equilibrium quantity.

Example. Suppose that in the market for hamburgers, suppliers were able to use cheaper imports of raw meats to produce hamburgers and as a result they would be willing to sell more hamburgers at every price. This increase in supply is represented by a shift of the supply curve from SS to S'S', as shown in Diagram 4.4.1.2(1).

(N.B./

Diagram 4.4.1.2(1) A Change in Supply with Demand Conditions Constant



(N.B. There is a difference between an increase in supply and an increase in the quantity supplied. The former refers to a shift in the whole position of the supply curve caused by a change in a factor other than the price of the good in question. The latter refers to an increase in the quantity which would be supplied if the price were to be higher, other factors remaining unchanged, and is represented by a movement along a supply curve.)

Assuming no change in the demand for hamburgers, there would be excess supply at the original equilibrium price of 40c. since consumers would still wish to buy 90,000 hamburgers per week whereas suppliers would be prepared to sell 150,000 hamburgers per week at 40c. each. The forces illustrated in 4.3.1.1 would generate downward pressure on price until a new equilibrium price of 30c. were reached, where the supply curve S'S' intersects the demand curve.

As a result of the increase in supply, the new equilibrium price would be lower than the original equilibrium price, and the new equilibrium quantity of 120,000 hamburgers per week would be greater than the original equilibrium quantity of 90,000 per week.

Conversely, if hamburger suppliers were to experience a rise in production costs following an increase in wages paid to all workers employed in producing hamburgers, and were prepared to supply fewer hamburgers at every price, this would be represented by a shift of the supply curve from SS to S"S".

Assuming no change in the demand curve, there would be excess demand for hamburgers at the original equilibrium price of 40c. since consumers would still wish to buy 90,000 per week whereas suppliers would be prepared to sell only 30,000 per week. As explained in 4.3.1.2 forces would generate upward pressure on price until a new equilibrium position were reached. In this market it would occur at a price of 50c. and a quantity of 60,000 hamburgers where the supply curve S"S" intersects the demand curve.

As a result of the decrease in supply, the new equilibrium price would be higher than the original equilibrium price, and the new equilibrium quantity of 60,000 hamburgers per week would be lower than the original equilibrium quantity of 90,000 per week.

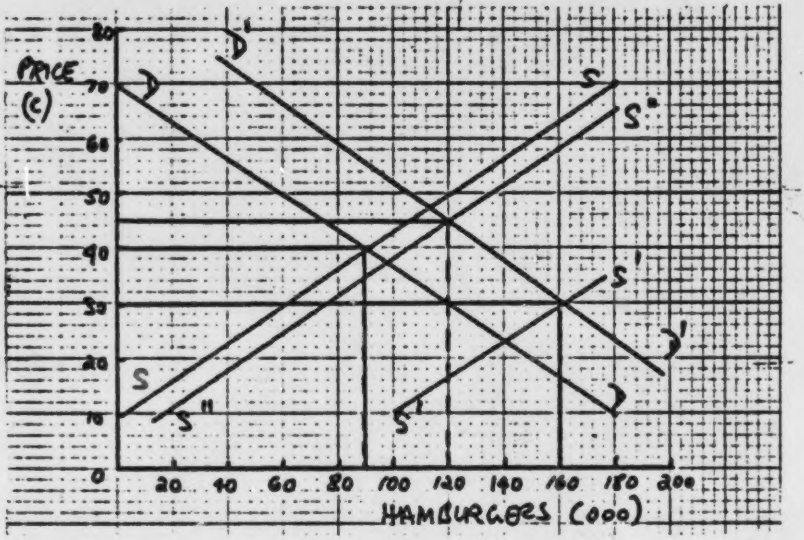
In each of the above examples the new equilibrium price and equilibrium quantity would be determined as a result of a shift in the supply curve and a movement along an unchanged demand curve.

4.4.1.3 If there were an increase in demand for a good and simultaneously an increase in supply of the good, the equilibrium quantity would rise/

rise. The equilibrium price of the good, however, could rise, fall or remain the same, depending on the extent to which demand increased relative to supply.

Example. In the market for hamburgers in a U.S. city represented in Diagram 4.4.1.3(1), suppose the demand for hamburgers were to increase as a result of a rise in the prices of other meat products, and the supply of hamburgers were also to increase as a result of a fall in production costs.

Diagram 4.4.1.3(1) An Increase in Demand and an Increase in Supply



The increase in demand is shown by the shift in the demand curve from DD to D'D' and the increase in supply is indicated by the shift of the supply curve from SS to S'S'. As a result of these simultaneous changes the equilibrium price of hamburgers would fall from 40c. to 30c., as indicated by the intersection of D'D' and S'S'. The new equilibrium quantity would increase from 90,000 per week to 160,000 per week.

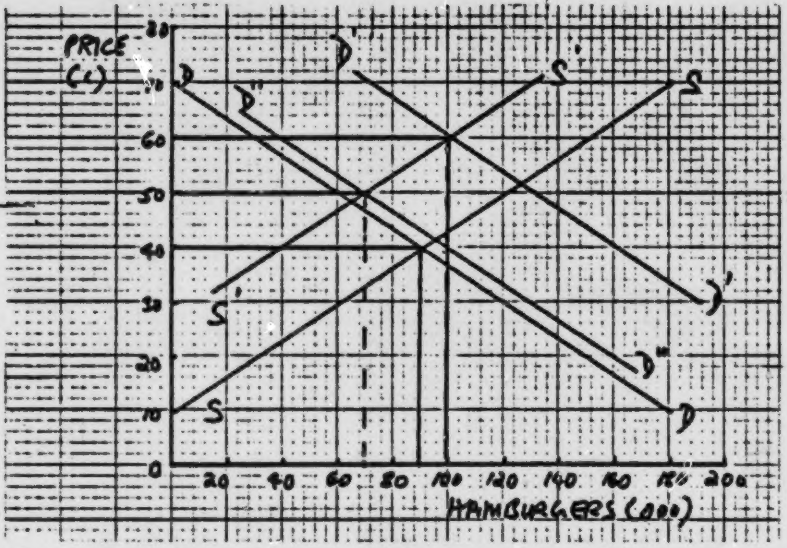
While the equilibrium quantity will always increase as a result of these increases in supply and demand, equilibrium price might rise or even remain at the original level instead of decreasing. If the supply curve were to shift only slightly from SS to S"S", the new equilibrium price and quantity would be 45c. and 120,000 per week, i.e. equilibrium quantity would increase and equilibrium price would increase also. In addition, it would be possible for both curves to shift just sufficiently to maintain equilibrium price at 40c.

4.4.1.4 If the demand for a good were to increase and the supply of the good were/

were to simultaneously decrease, the equilibrium price of the good would rise. The equilibrium quantity of the good might increase, decrease or remain the same depending on the extent of the relative changes in demand and supply.

Example. In the market for hamburgers, suppose consumers wish to buy more at every price as a result of an increase in the prices of all other meats, and that simultaneously hamburger suppliers were to experience a rise in production costs. The impact of these changes in supply and demand is illustrated in Diagram 4.4.1.4(1).

Diagram 4.4.1.4(1) An Increase in Demand and a Decrease in Supply



The demand curve would shift from DD to D'D' and the supply curve would shift from SS to S'S'. As a result, the new equilibrium price and quantity are established where D'D' and S'S' intersect. The new equilibrium price would be 60c. and the new equilibrium quantity would be 100,000 per week, both of which are higher than the original equilibrium levels.

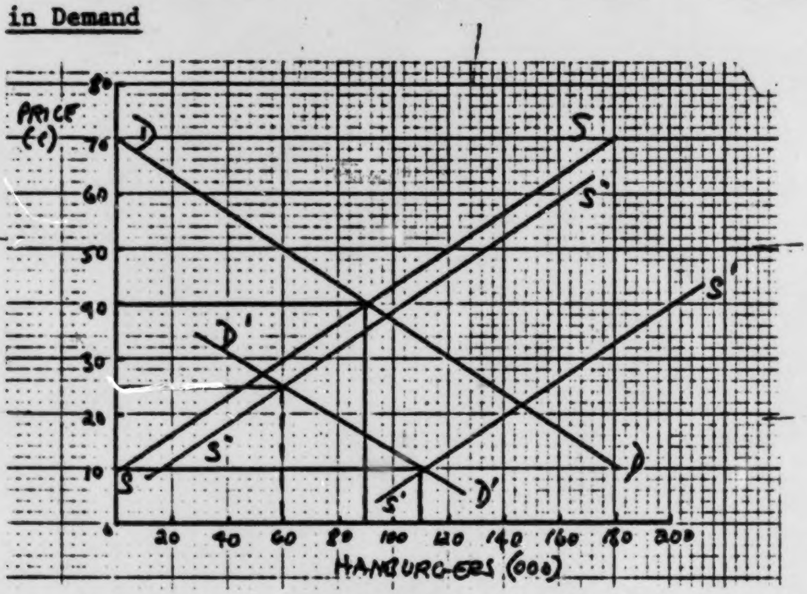
While equilibrium price would always rise as a result of these two simultaneous changes in supply and demand, equilibrium quantity might fall, or remain at the same level instead of increasing. If the demand curve were to shift only slightly from DD to D"D" the new equilibrium price and quantity would be 50c. and 70,000 hamburgers per week. So although equilibrium price would still increase, equilibrium quantity would fall from its original level. Also, it would be possible for both curves to shift just sufficiently to maintain the equilibrium quantity at 90,000 per week.

4.4.1.5/

4.4.1.5 **If the supply of a good were to increase and the demand for the good were to simultaneously decrease, the equilibrium price of the good would fall but the equilibrium quantity might increase, decrease or remain at the same level.**

Example. Suppose that suppliers discovered a more efficient method of producing hamburgers and that simultaneously consumers learned that there might be a health risk involved in eating hamburgers. The effect of these changes in the market for hamburgers is illustrated in Diagram 4.4.1.5(1).

Diagram 4.4.1.5(1) **An Increase in Supply and a Decrease in Demand**



The increase in supply is denoted by the shift in the supply curve from SS to S'S' and the decrease in demand by a shift in the demand curve from DD to D'D'. The point at which D'D' and S'S' intersect denotes the new position of equilibrium in the market, i.e. a price of 10c. and a quantity of 110,000 hamburgers per week bought and sold.

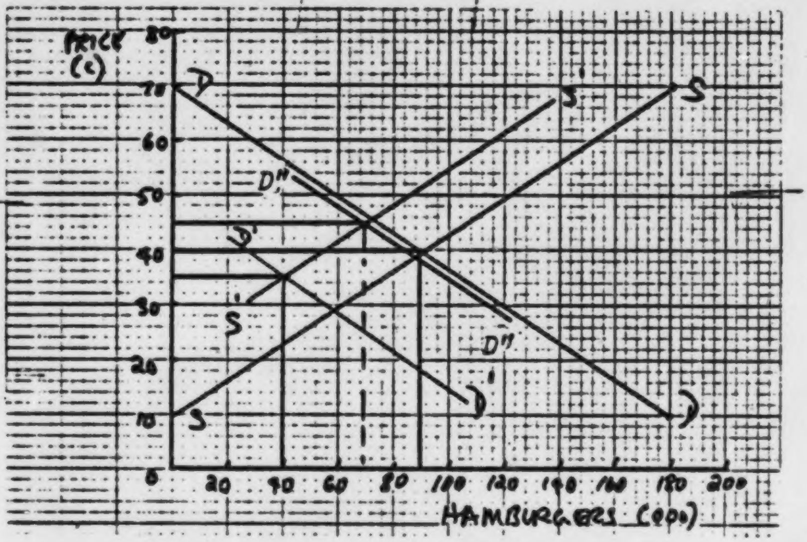
Although equilibrium price of the good would always fall as a result of these two changes in supply and demand, equilibrium quantity might fall or remain unchanged instead of increasing. If the supply curve were to shift from SS to S"S" instead of to S'S', the new equilibrium price and quantity would be 25c. and 60,000 hamburgers per week, i.e. the equilibrium price would decrease and the equilibrium uuantity would decrease also. It would be possible for both curves to shift just sufficiently to maintain the equilibrium quantity at 90,000 per week.

4.4.1.6/

4.4.1.6 **If the demand for a good and the supply of a good were both to decrease, the equilibrium quantity of the good would fall, but equilibrium price might increase, decrease or remain at its original level.**

Example. Suppose that some consumers substituted hot dogs for hamburgers, and simultaneously hamburger producers experienced a rise in costs. The impact of these two changes is shown in Diagram 4.4.1.6(1).

Diagram 4.4.1.6(1) A Decrease in Demand and a Decrease in Supply



The decrease in demand is represented by a shift in the demand curve from DD to D'D' and the decrease in supply by a shift from SS to S'S'. As a result, the equilibrium price would fall from 40c. to 35c. and the equilibrium quantity would fall from 90,000 hamburgers per week to 40,000 per week.

Although equilibrium quantity would always fall as a result of a simultaneous decrease in supply and demand, equilibrium price could increase or remain unchanged instead of decreasing. If the demand curve shifted only slightly from DD to D"D" instead of to D'D', the new equilibrium price would be 45c. which is higher than the original equilibrium price. And it would be possible for both curves to shift just enough to maintain equilibrium price at 40c.

4.5 Intervention in the Market

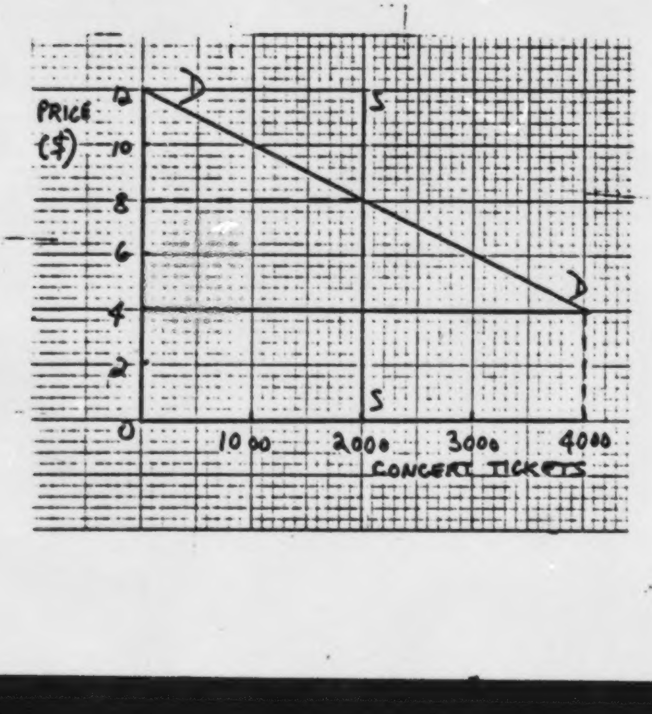
4.5.1 **Market intervention or market regulation occurs when a non-market force causes the price and quantity of a good bought and sold in a competitive market to be different from the price/quantity combination which would occur if the market were allowed to operate freely.**

> *Example. Tickets for major sporting events such as the Wimbledon tennis tournament in London, and Muhammad Ali's World championship fights are often priced below the level which would occur if the forces of supply and demand were allowed to operate freely. The result is that more people wish to buy tickets at the prevailing price than there are tickets available. Conversely, minimum wage laws in the U.S. which stipulate that employees in certain firms must be paid at least $2.30 per hour provide an example of the price in a resource market which is set above the equilibrium level, since more people are willing to work at $2.30 per hour than there are jobs available.*

4.5.1.1 **When the price of a good is fixed below the equilibrium level, a price ceiling is said to exist in the market for the good. Price alone will be an inadequate mechanism for allocating the available supply of the good among potential buyers, and some other allocative mechanism such as first come - first served, reliance on suppliers' preferences, or rationing, may be employed.**

> *Example. When world famous pop groups stage a concert, such as the Beatles' famous concert at the Hollywood Bowl, the price of the tickets is often below the equilibrium price which would be established if tickets were sold without restriction in a competitive market.*

Diagram 4.5.1.1(1) A Price Ceiling in a Market



Suppose Diagram 4.5.1.1(1) illustrates the market for a pop concert in a concert hall where the capacity is 2000 identical seats. Supply is therefore represented by the completely inelastic supply curve SS. If the demand schedule for tickets were represented by DD, the equilibrium price would be $8 per ticket.

But if the organizers of the concert decided to fix the price of tickets at $4 each, excess demand for tickets would exist. In fact, at a price of $4 twice as many people would wish to see the concert as there are seats available, since at $4 each 4000 tickets would be desired.

Some way would have to be found of allocating the available 2000 tickets among potential buyers. One obvious method would be to allocate tickets to the first 2000 buyers who appeared This is why large queues are often seen when tickets for major events go on sale.

Alternatively the concert organizers might allocate some of the 2000 tickets according to their own preferences, e.g.to personal friends, disc jockeys, and other showbusiness personalities. In addition, a system of rationing might be used, whereby each individual would be allowed to purchase a limited number of tickets, e.g. two.

When price ceilings are in operation and excess demand exists, a black market tends to develop, in which unites of a good are exchanged for prices higher than the fixed level. Black markets, despite being illegal, serve the function of establishing equilibrium prices and quantities in a market. If the black market is 'perfect', the higher price will be the equilibrium price, i.e. all buyers who want a ticket at that price can obtain one, and any ticket owner who wishes to sell a ticket at that price can do so.

The motivation for exchange at black market prices exists because, as shown by the downward sloping demand curve, some individuals are prepared to pay much higher prices than others to obtain units of a good and there is no guarantee that those individuals who are willing to pay higher prices actually receive any units of the good by the initial allocation.

In the hypothetical market for pop concert tickets, for example, there is at least one individual who is prepared to pay up to $12 for a ticket, and at least one individual who would be willing to pay the fixed price of $4 but no more. Suppose the latter individual actually obtains a ticket for $4 by turning up early when the tickets go on sale, but that the former individual arrives too late and discovers that the tickets have all been sold. Exchange would be possible between these two individuals/

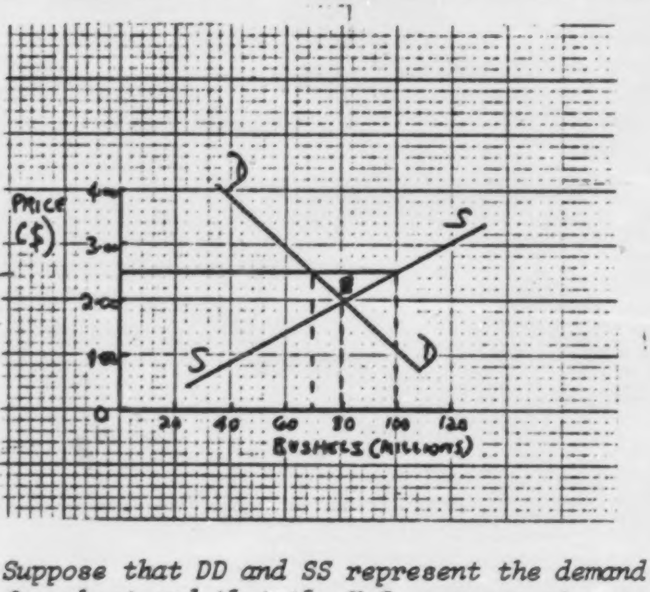
individuals because the person with the ticket would prefer any sum of money above $4 to the ticket, whereas the person without a ticket would be prepared to sacrifice up to $12 to obtain a ticket. This exchange of a ticket for a price between $4 and $12 can occur because both individuals would gain by the exchange.

In this one-to-one situation, the price of the ticket is indeterminate - it will lie between $4 and $12, and will depend ultimately on the bargaining skills of the buyer and seller. However, if two similar buyers and one seller constituted the market the price of the ticket would be $12, and conversely if one buyer and two similar sellers constituted the market, the price of the ticket would be $4.01.

4.5.2 When the price of a good is fixed above the equilibrium level, a price floor is said to exist in the market for the good. At the fixed price there would be excess supply of the good, and some method other than price would have to be found of disposing of the surplus.

Example. For many years until the late 1960s the prices of many agricultural goods in the U.S. were fixed above the equilibrium level. Diagram 4.5.2(1) illustrates the implications of such price floors in a wheat market.

Diagram 4.5.2(1) A Price Floor in a Wheat Market



Suppose that DD and SS represent the demand and supply curves for wheat and that the U.S. government were to set a price floor at $2.50 per bushel, which is higher than the equilibrium price of $2.00 as shown at point E. The quantity of wheat which/

which farmers would be prepared to supply at $2.50 is 100 million bushels per year, whereas the quantity of wheat consumers would be prepared to buy at the regulated price is 70 million bushels per year. Hence a situation of excess supply of 30 million bushels per year would exist with a $2.50 per bushel price floor.

In imposing a price floor, the regulating agency faces the problem of disposing of the excess supply. One solution would be to destroy the surplus. While this is obviously a waste of resources, some European countries, notably France, have resorted to this course of action for many agricultural goods. Society as a whole suffers because fewer goods are available, but if the demand for these agricultural goods is relatively inelastic the income of the farmers, i.e. revenue from the sale of these agricultural goods, will be higher, the higher the price. Indeed, such an argument is often used to justify these schemes.

Alternatively, the government could buy the surplus, stockpile it, and release it on to the market at a time when crop production was very low. Such a scheme could help stabilise price over time. In 1958 - a year of extremely high excess supply of certain crops - the U.S. government purchased 260 million bushels of grain, 260 million bushels of corn, and over 500 million bushels of wheat.

Another option is to sell the surplus wheat abroad. In recent years large sales of such wheat to Russia have occurred.

One further choice available to the government is to pay farmers not to produce the excess supply. In Diagram 4.5.2(1) this would involve the government trying to restrict the quantity of wheat supplied to 70 million bushels per year. This policy has been tried by the U.S. government, and many farmers have been paid by the government not to produce!

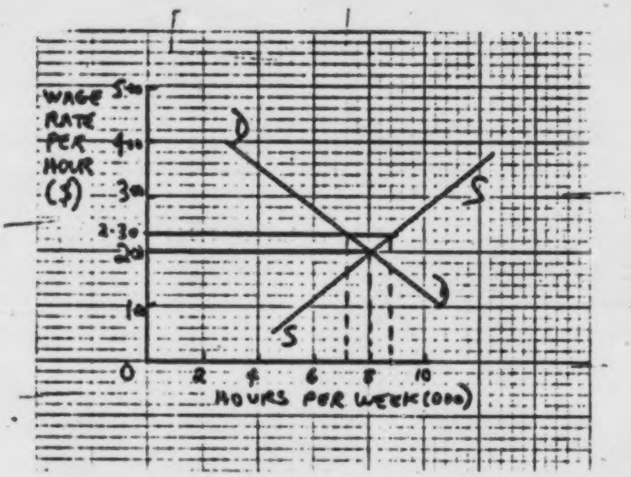
One further example of price floors, this time in a resource market, is the minimum wage law which operates in the U.S. This law makes it illegal for certain types of firms to hire labor at less than $2.30 per hour.

Suppose that Diagram 4.5.2(2) illustrates a hypothetical market for low skilled labor. According to the market demand and supply schedules, the equilibrium wage rate would be $2.00 per hour. At that rate, 200 people each working 40 hours per week would be employed, i.e. the quantity of labor offered and hired at $2.00 per hour would be equivalent to 8,000 hours per week.

But if a legal minimum wage of $2.30 were in effect, an excess supply of low skilled labor would exist. Individuals would wish/

wish to work 8,800 hours per week, i.e. 220 people would wish to be employed at a rate of $2.30 per hour. Firms, however, would wish to employ individuals to work 7,200 hours per week, i.e. they would wish to employ 180 people at a rate of $2.30 per hour.

Diagram 4.5.2(2) Effect of a Minimum Wage Law in a Competitive Labor Market



There would be excess supply of labor amounting to 40 people, comprising 20 extra people who would wish to work at a rate of $2.30 compared with $2.00, and 20 people originally employed at $2.00 but whom firms would no longer be willing to hire at $2.30. The 180 people who remain employed, however, would be better off than before.

Many economists have tried to discover the impact of minimum wage legislation on employment, especially on those sections of the labor force, such as teenagers and low skilled workers, who would be most affected by minimum wage laws. A study by Y. Brozen[1] in the late 1960s found that in the U.S. successive increases in the legal minimum wage were reflected in rising teenage unemployment, and some years later T. G. Moore[2] discovered that the unemployment rate of non-whites in the 16-19 age range increased by 1.8% for each 1% rise in the ratio of the legal minimum wage to the average hourly earnings of production workers in private, non-agricultural employment.

Controversy rages in the U.S. about minimum wage laws. Some people benefit, others suffer, but there is little disagreement that such laws cause unemployment among various groups of workers and consequently make total output lower than it otherwise would be.

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[1] Y Brozen, "The Effect of Statutory Minimum Wage Increases on Teenage Unemployment," Journal of Law and Economics, v.12 (April 1969)

[2] T G Moore, "The Effect of Minimum Wages on Teenage Unemployment Rates," Journal of Political Economy, v.79 (July/August 1971) p 901

4.5.3 **The equilibrium price and equilibrium quantity of a good may be changed by the imposition of a tax on each unit of the good bought and sold.**

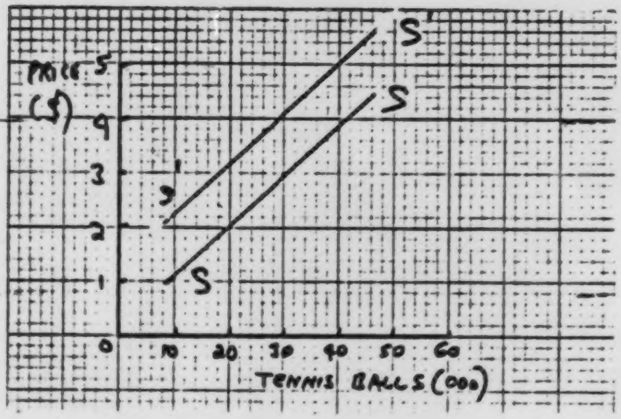
Example. Table 4.5.3(1) gives data relating to the supply schedules in the market for tennis balls before and after the imposition of a tax of $1 per tennis ball.

Table 4.5.3(1) **Effect of a Tax on the Supply Schedule of a Good**

Price $	Quantity Supplied per week	Price plus Tax $
1	10,000	2
2	20,000	3
3	30,000	4
4	40,000	5
5	50,000	6

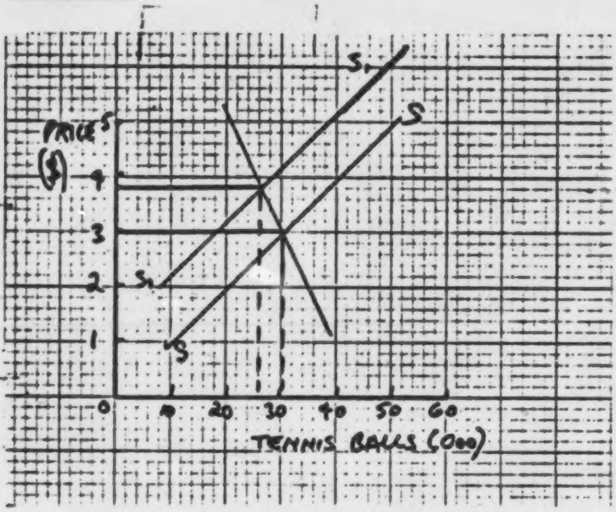
The imposition of a tax affects the market supply curve through its impact on the marginal cost curve of each producer, who would now have to pay to the government $1 in tax for every tennis ball sold. Hence suppliers would be willing to supply the same quantities of tennis balls at prices $1 higher than the original prices. This change in suppliers' intentions can be represented by a shift of the supply curve for tennis balls from SS to S'S' as shown in Diagram 4.5.3(1).

Diagram 4.5.3(1) **Shift of Supply Curve due to Tax**



The shift of the supply curve merely indicates a change in sellers' intentions. To discover what actually happens to the equilibrium price and quantity of tennis balls it is necessary to compare the point of intersection of the supply and demand curves for tennis balls before and after the tax.

Diagram 4.5.3(2) Effect of Tax on Equilibrium Price and Quantity

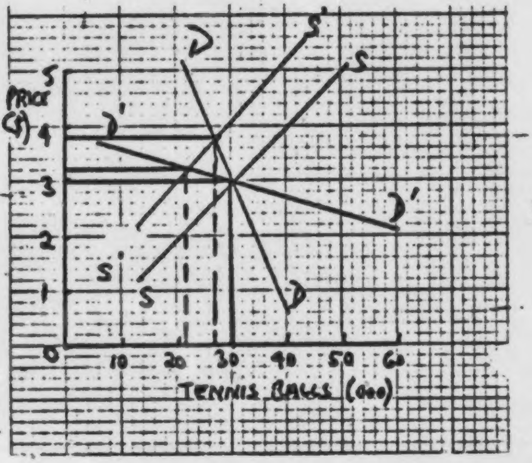


As shown in Diagram 4.5.3(2) the equilibrium price of tennis balls would rise from $3 to $3.75, and the equilibrium quantity would fall from 30,000 to 26,000.

4.5.4 If a tax were to be imposed on every unit of a good bought and sold, the extent to which equilibrium price and quantity would change, and the incidence of the tax between consumers and producers, would depend on the relative elasticities of supply and demand.

Example. If the demand for tennis balls were represented by DD as illustrated in Diagram 4.5.4(1) then for every dollar paid to the government in tax, three-quarters would fall on consumers because of the price rise from $3 to $3.75. The remaining one-quarter would fall on producers whose revenue from the sale of each tennis ball would fall by 25c., i.e. from $3 to $2.75 ($3.75 - $1 tax = $2.75).

Diagram 4.5.4(1) **Effect of Tax on Equilibrium Price and Quantity with Different Demand Elasticities**



But if the demand for tennis balls were represented by the more elastic demand curve D'D', the price after a tax of $1 per tennis ball was imposed would rise to $3.25, and the quantity bought and sold would fall to 23,000. For every $1 paid to the government in tax, only one-quarter would fall on consumers through the rise in price from $3 to $3.25. The remaining three-quarters would fall on producers whose revenue from the sale of each tennis ball would now be reduced by 75c., i.e. from $3 to $2.25 ($3.25 - $1 tax = $2.25).

4.5.5 **If a tax were imposed on every unit of a good bought and sold, there would be a loss of both consumer surplus and producer surplus.**

Example.

Diagram 4.5.5(1) Effect of a Tax on Consumer Surplus and Producer Surplus

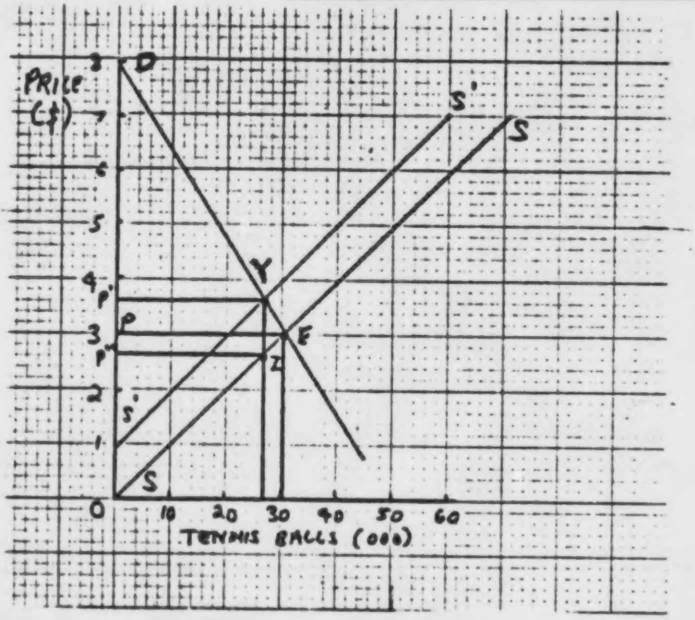


Diagram 4.5.5(1) again illustrates the effect of a tax on the market for tennis balls. At the pre-tax equilibrium price of \$3, consumer surplus is denoted by the area DPE (see 4.3.3.1). At the post-tax equilibrium price of \$3.75 consumer surplus is denoted by the smaller area DP'Y. Hence the loss of consumer surplus due to the imposition of the tax is denoted by the area P'PEY.

At the pre-tax equilibrium price of \$3, producer surplus is denoted by the area OPE (see 4.3.3.2). The post-tax price, net of tax, received by producers is \$2.75. At this price, producer surplus is denoted by the smaller area OP"Z. Hence the loss of producer surplus due to the imposition of the tax is denoted by P"PEZ.

The imposition of a tax, by raising the price paid by individuals for the good and lowering the price received by suppliers from the sale of the good, reduces the volume of transactions and thus reduces the gains from exchange.

4.6 Dynamic Adjustments in the Market

4.6.1 When conditions of demand and/or supply change in a market, a new equilibrium price or equilibrium quantity, or both, will be established. This method of analyzing market changes is called comparative statics since it involves comparing equilibrium points before and after certain demand or supply changes occur. But the analysis does not stipulate the time necessary for a new equilibrium to be established, nor does it trace the exact process by which a market adjusts from one equilibrium point to another.

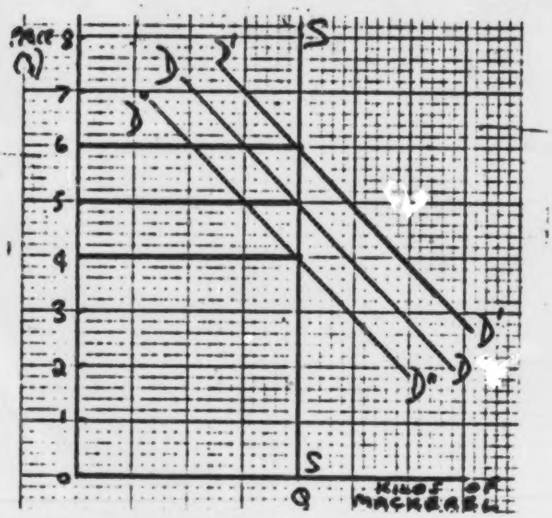
Example. Although it was shown in 4.4.1.1 that an increase in demand for hamburgers would lead to an increase in the equilibrium price of hamburgers, say from 40c. to 50c., the analysis does not specify whether the price of hamburgers would move up from 40c. to 50c. in one jump, or more gradually by one cent increases until equilibrium is restored, or even whether price would suddenly rise above 50c. immediately following the demand increase and then fall to the new equilibrium level.

4.6.2 When the demand for a good changes, price would reach different levels in different time-periods depending upon differences in elasticities of supply.

4.6.2.1 If a change in demand were to occur while a market was in progress, and the supply curve for a good were completely inelastic, indicating that producers were unable to adjust the quantity supplied no matter the price in the 'market period', the equilibrium price would change, but there would be no change in equilibrium quantity.

Example. If there were a sudden increase in demand in the market for mackerel in a given day (the market period), suppliers would be unable to bring any more mackerel to the market. The effect of this is illustrated in Diagram 4.6.2.1(1).

Diagram 4.6.2.1(1) **An Increase in Demand in the Market Period**



The market is initially in equilibrium with a price of $5 per kilo and OQ kilos of mackerel are bought and sold. But in this initial market period, a rise in demand for mackerel as shown by a shift in the demand curve from DD to D'D' would result solely in a rise in price from $5 to $6 per kilo. Equilibrium quantity of OQ kilos would remain the same because in this time period the supply curve SS is completely inelastic, i.e. the time period is too short to catch more mackerel and bring them to market.

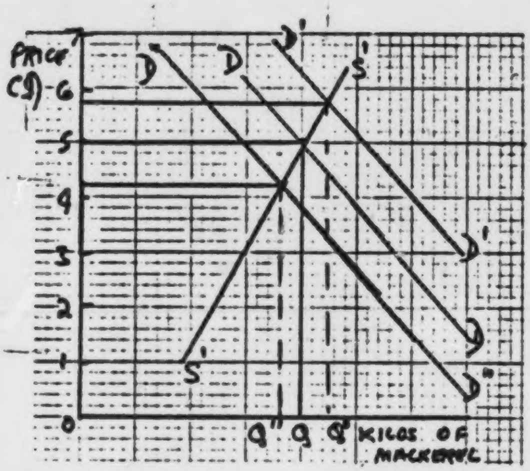
Conversely, if there were to be a sudden decrease in demand for mackerel as indicated by the shift of the demand curve from DD to D"D", in the market period equilibrium price would fall from $5 to $4 per kilo but equilibrium quantity of OQ kilos would remain.

4.6.2.2 In the short run the supply of a good would be less inelastic than in the market period because suppliers would be able to adjust the quantity hired of the variable factors of production. Comparing the short run with the market period given a change in demand, equilibrium price would change but not by as much as in the market period. Equilibrium quantity would change.

Example. Following an increase in demand, in the short run period suppliers would employ more labor and/or get existing employees/

employees to work overtime in order to catch more mackerel. The supply curve for this period would be represented by S'S' which is less inelastic than the supply curve SS in the market period. The short run period is illustrated in Diagram 4.6.2.2(1).

Diagram 4.6.2.2(1) An Increase in Demand in the Short Run



The equilibrium price in the short run would be $5.75 per kilo, as shown by the intersection of D'D' and the short run period supply curve S'S'. This price is higher than the initial equilibrium price of $5 but lower than the market period equilibrium price of $6. Equilibrium quantity would also increase from OQ to OQ' kilos of mackerel.

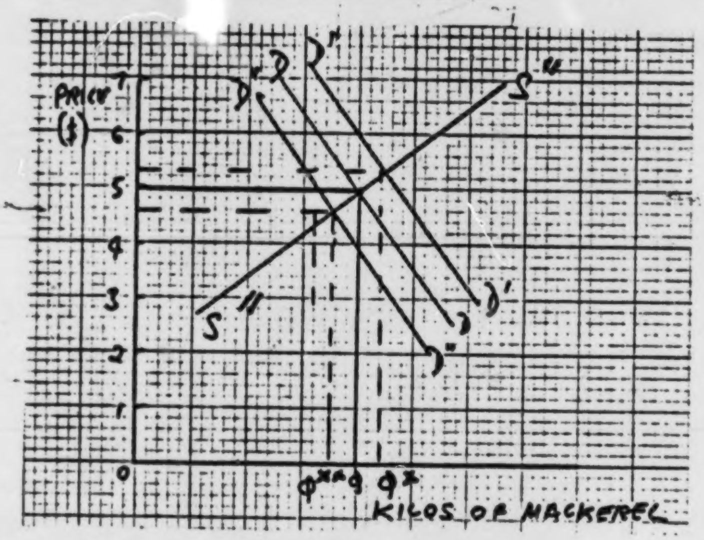
Similarly, following a decrease in demand as indicated by a shift of the demand curve from DD to D"D", equilibrium price would fall from $5 to $4.25 per kilo, which is not as large a fall as occurred in the market period. Equilibrium quantity would also fall from OQ to OQ".

4.6.2.3 In the long run, the supply of a good would be more elastic than in the short run because producers would be able to alter the quantities hired of all factors of production, and firms would be able to enter or leave the industry. Equilibrium price would differ from its original level but not by as much as in the short run period, provided the long run supply curve were upward sloping. If the long run supply curve were completely elastic, price would return to its original level. Equilibrium quantity would change by more in the long run than in the short run.

Example. Following an increase in demand for mackerel, in the long/

long run suppliers would be able to order more fishing boats as well as employing more variable factors, and new suppliers would be able to enter the market. Assuming that costs were to rise as firms expand and as new firms enter the market, the long run supply curve would slope upwards (see Unit 3.8.1), but would be more elastic than in the short run, as shown in Diagram 4.6.2.3(1).

Diagram 4.6.2.3(1) An Increase in Demand in the Long Run with Upward Sloping Supply Curve

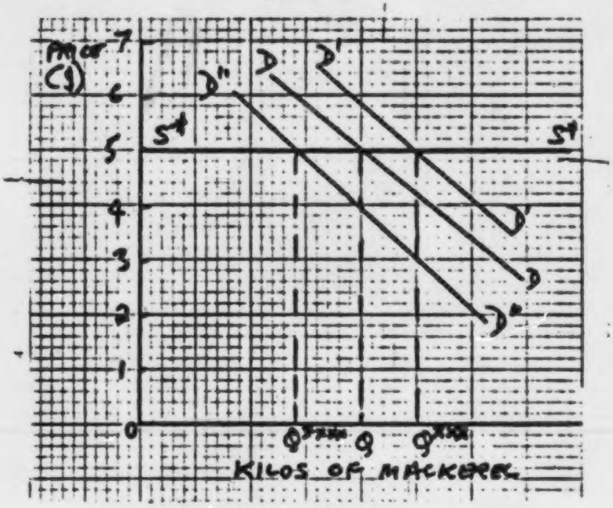


The equilibrium price in the long run would be $5.50 per kilo, determined by the intersection of DD with the long run supply curve S"S". This price is higher than the original equilibrium level but lower than equilibrium price in the short run. Equilibrium quantity would be OQ which is greater than equilibrium quantity in the short run.*

*Similarly, following a decrease in demand for mackerel as represented by a shift of the demand curve from DD to D"D", equilibrium price would fall to $4.50 which is higher than its level in the short run. Equilibrium quantity would be OQ** which is lower than the short run equilibrium quantity.*

*If, however, costs are unaffected by firms entering the market, the long run supply curve will be a horizontal line S*S* (see Unit 3.8.1) as shown in Diagram 4.6.2.3(2).*

Diagram 4.6.2.3(2) An Increase in Demand in the Long Run with Horizontal Supply Curve



*As a result of a change in demand, equilibrium price would be restored to its original level of $5 per kilo. Equilibrium quantity, however, would change by more than in the short run, rising to OQ*** as a result of an increase in demand, and falling to OQ**** as a result of a decrease in demand.*

4.6.3 In the markets for some goods and resources whose supply adjusts only after a time lag, the prices of those goods and resources tend to fluctuate in a cyclical fashion over time.

Example. For many years in the U.S. the price of pigs oscillated from year to year, sometimes reaching relatively high levels and sometimes relatively low levels. Given the time required for breeding and fattening, the quantity supplied by pig farmers could respond to market changes only after many months had elapsed.

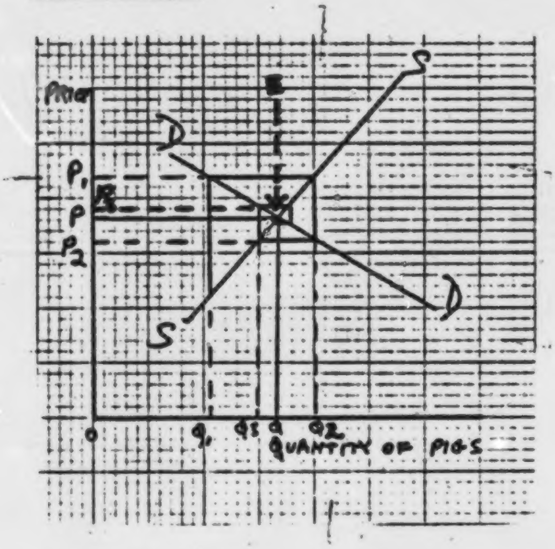
Similar patterns have occurred in the markets for resources such as physicists in the U.S., whose salaries moved substantially ahead of the levels earned in similar highly qualified occupational groups in the late 1950s and early 1960s, but then significantly declined in relation to comparable salaries in the late 1960s and early 1970s.

4.6.4 Markets which operate in such a cyclical fashion are often analyzed using what is known as a "cobweb model". Although it uses conventional tools of supply and demand, it is different in that the/

the market being analyzed operates in discrete blocks of time, and the supply curve contains a time-lag, i.e. it relates one period's prices with the next period's quantities.

Example. In Diagram 4.6.4(1) suppose the curves DD and SS represent hypothetical demand and supply curves for pigs.

Diagram 4.6.4(1) The "Cobweb" Model - Convergence towards Equilibrium



If the market were initially in equilibrium at E, then the quantity of pigs which farmers would plan to produce would just match consumers' demands for pork. But suppose instead that there has been widespread disease amongst pigs causing the quantity which farmers would supply to fall to OQ_1*, which is below the equilibrium level.*

The price which OQ_1 *will fetch on the market is* OP_1*, i.e. the price which consumers, as shown by the curve DD, are prepared to pay for* OQ_1 *units. But the relatively high price in this time period will induce farmers to increase significantly their planned supply of pigs for next year. If farmers use price* OP_1 *as a basis for determining next year's supply of pigs, they would bring* OQ_2 *units to the market. But the price which clears the market of* OQ_2 *is* OP_2*, i.e. the price according to curve DD which consumers would pay for* OQ_2 *pigs. This price is below the equilibrium level, whereas the previous price of* OP_1 *was above the equilibrium level.*

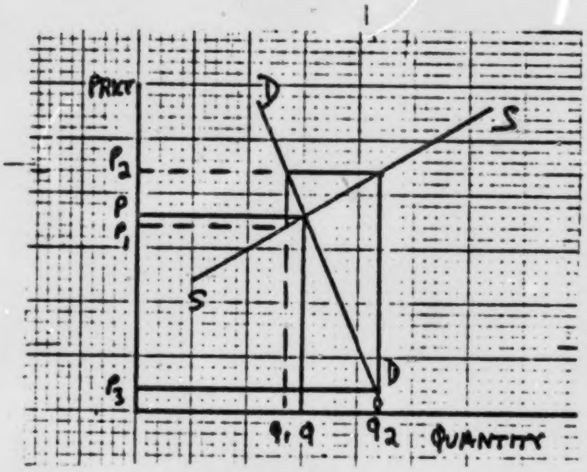
But in response to this relatively low market price, farmers will cut back on production plans and be prepared to supply next year only OQ_3 at a price of OP_2. When OQ_3 pigs arrive at the market, the clearing price will be OP_3, which is once more above the equilibrium level.

And so the process of cyclical price movement goes on. But in each time period, price moves closer to the equilibrium level until, as shown in Diagram 4.1.4, OP is finally reached. Over a period of time the market has converged towards equilibrium.

4.6.5 In some markets, using the cobweb model, cyclical movements in price do not converge towards equilibrium but move further away from equilibrium.

Example. In Diagram 4.6.5(1) if price were initially at OP_1, in each succeeding time period price would gradually diverge from the equilibrium level; it would move to OP_2, OP_3, etc.

Diagram 4.6.5(1) Price Diverges from Equilibrium



4.6.6 Using the cobweb model, whether a market will converge or diverge will depend upon the relative slopes of the demand and supply curves. When the supply curve is steeper than the demand curve price will converge towards equilibrium. When the demand curve is steeper than the supply curve, price will diverge from equilibrium.

Example. In Diagram 4.6.4 the supply curve SS is steeper than the demand curve DD, and price converged towards the equilibrium level OP from a situation in which the market was not in equilibrium. As price changes, suppliers adjust quantity less than do consumers, and this has a dampening effect on the cyclical movements around equilibrium.

In Diagram 4.6.5 the demand curve DD has a steeper slope than the supply curve SS, and from an original disequilibrium situation represented by price OP_1*, the price in successive time periods diverged from equilibrium. As price changes, buyers adjust the quantity demanded more than producers adjust quantity supplied, and so the cyclical price movements diverge increasingly from the equilibrium level.*

4.6.7 The cobweb model of dynamic adjustment depends on the further assumption that producers never learn from experience, and adjust their production plans accordingly. It also depends on the assumption that speculators, i.e. people who may buy quantities of the good at low prices and then re-sell later at high prices, have no role to play in the market.

Example. It is highly unlikely in the real world that, over a period of years, producers and consumers would learn nothing about the way in which the market was behaving and adjust their behavior accordingly. Pig farmers would obviously realize that basing next year's production plans on this year's prices and the expectation they would prevail was an unrealistic assumption. Despite the learning by doing effect, the cobweb model provides a realistic explanation of some markets such as the world shipbuilding market which throughout its history has been subject to feasts and famines.

MICRO UNIT 5

MARGINAL EQUIVALENCY CONDITIONS AND ECONOMIC EFFICIENCY

5.1 The Marginal Equivalency Conditions

5.2 Resource Allocation and Profit Maximizing Behavior in the Short Run

5.3 Resource Allocation and Profit Maximizing Behavior in the Long Run

5.4 The Wonderful World of Adam Smith vs. The Real World

5.1 The Marginal Equivalency Conditions

5.1.1 **A consumer will maximize utility from a given income when that income is allocated to goods and services so that the marginal utility of each good and service divided by its price is equal (2.4.2).**

$$\text{i.e. } \frac{MU_A}{P_A} = \frac{MU_B}{P_B} = \dots\dots\dots\dots\dots\dots\dots = \frac{MU_N}{P_N}$$

Example. In a hamburger - beer world in which the price of a hamburger is 4 times the price of a glass of beer, a utility maximizing student will allocate his income to beer and hamburgers such that the last dollar spent on each will yield equal satisfaction, i.e. the last hamburger consumed will yield 4 times the utility of the last glass of beer consumed.

5.1.2 A competitive firm will maximize profit by producing that level of output at which price equals marginal cost (3.5.5).

$$\text{i.e. } P_A = MC_A$$

Example. If the market price of pencils is 10c. each and if a competitive pencil manufacturer is producing a level of output where the marginal cost is 8c., he will not be maximizing profits. The production of additional pencils until the marginal cost rose to 10c. would add more to revenue than it would to cost and consequently add to profit or diminish loss.

5.1.3 Assuming a two good world (goods A and B) composed of utility maximizing consumer and profit maximizing competitive firms, the following conditions must hold:

$$\frac{MU_A}{P_A} = \frac{MU_B}{P_B} \quad \dots \quad \dots \quad \dots (1)$$

and

$$P_A = MC_A \text{ and } P_B = MC_B \dots (2)$$

Substituting the MC's of equation (2) for the P's in equation (1) results in:

$$\frac{MU_A}{MC_A} = \frac{MU_B}{MC_B} \quad \dots \quad \dots \quad \dots (3)$$

Because MU_A is the utility gained from consumption of the last unit of good A and MC_A is the dollar resources required to produce that unit, $\frac{MU_A}{MC_A}$ is the utility gained by a consumer from the last dollar's worth of resources in the production of good A. Similarly, $\frac{MU_B}{MC_B}$ is the utility gained by a consumer from the last dollar's worth of resources in the production of good B. Thus equation (3) signifies that for each utility maximizing consumer in a two good world in which the goods are produced by profit maximizing competitive firms the utility gained from the last dollar's worth of resources in the production of good A will equal the utility gained from the last dollar's worth of resources in the production of good B.

> *Example. If a grade maximizing student has 8 hours of study time remaining to allocate to History and Economics and allocates 4 hours to each he will not maximize total points unless the last hour allocated to History adds the same increase in points as it would if it were allocated to Economics. Suppose for example that the third hour allocated to History adds 10 points and the fourth hour adds a further 6 points.; whereas the fourth hour allocated to Economics adds 15 points and a fifth hour would add 10 points. To maximize total points the student should reallocate his fourth hour of History study to Economics. Total History points will decrease by 6 points but total Economics points will increase by 10 points, yielding a net gain of 4 points. The last hour allocated to each will yield the same increment to score, i.e. 10 points.*

5.1.4 Any allocation of resources which does not produce

$$\frac{MU_A}{MC_A} = \frac{MU_B}{MC_B}$$

results in a non equilibrium situation. Forces will cause a resource reallocation until the ratios of marginal utilities to marginal costs are equal for all goods and services.

> *Example. If* $\frac{MU_A}{MC_A} = \frac{4}{1}$ *and* $\frac{MU_B}{MC_B} = \frac{2}{1}$
> *e.g. the last dollar's worth of resources in the production of hamburgers yields twice the utility of the last dollar's worth of resources in the production of beer, society would experience a net gain in utility by moving resources out of industry B (beer) into industry A (hamburgers).*

5.1.4.1 If $\frac{MU_A}{MC_A} > \frac{MU_B}{MC_B}$ there will be an incentive for society to transfer resources from industry B to industry A. Fewer resources in industry B will reduce the quantity of B produced with a concomitant decrease in total utility from good B since less B will be consumed. However, the marginal utility of B will increase because of the assumption of diminishing marginal utility (2.3.2.7).

More resources in industry A will increase the quantity of A produced with a concomitant increase in total utility from good A since more A will be consumed. However, the marginal utility of A will decrease because of the assumption of diminishing marginal utility. Since $\frac{MU_A}{MC_A} > \frac{MU_B}{MC_B}$, the reallocation of resources at the margin from industry B to industry A will result in a net gain of total utility.

> *Example. If* $\frac{MU_A}{MC_A} = \frac{4}{1}$ *and* $\frac{MU_B}{MC_B} = \frac{2}{1}$ *the net result of reallocating $1 of resources from industry B to A will be a gain in utility of 2, i.e. a loss in utility of 2 attributable to one fewer units of B being produced but a gain in utility of 4 attributable to one more unit of A being produced. Because society has less B, its marginal utility will decrease. Suppose after the reallocation of $1 of resources from industry B to A the new ratios are:*
>
> $\frac{MU_A}{MC_A} = \frac{3.5}{1}$ *and* $\frac{MU_B}{MC_B} = \frac{2.5}{1}$
>
> *Since* $\frac{MU_A}{MC_A}$ *still exceeds* $\frac{MU_B}{MC_B}$ *the incentive remains for further resource reallocation. Only when* $\frac{MU_A}{MC_A} = \frac{MU_B}{MC_B}$
>
> *e.g. when* $\frac{MU_A}{MC_A} = \frac{3.15}{1} = \frac{MU_B}{MC_B} = \frac{3.15}{1}$
>
> *will there be no incentive for further reallocation since further reallocation would lead to net loss in total utility.*

5.1.5 When $\frac{MU_A}{MC_A} = \frac{MU_B}{MC_B}$ total utility will be maximized, i.e. society will experience the highest utility possible given its limited resources. Moreover, since for each good MC = price, each good will be being produced in an engineering efficient manner.

Thus when the marginal equivalency condition holds, i.e. when $\frac{MU_A}{MC_A} = \frac{MU_B}{MC_B}$, economic efficiency will prevail in the economy. Each good will be produced using the least amount of resources and the goods which are produced will be produced in those quantities which yield the highest possible level of satisfaction.

Example. In a society which chooses to allocate all of its resources to the production of beer and hamburgers, and in which competitive conditions of production hold, when the $\frac{MU}{MC}$ *of beer equals the* $\frac{MU}{MC}$ *of hamburgers the society will be enjoying the highest possible level of utility. Producing more beer and fewer hamburgers or less beer and more hamburgers would result in a lower level of total utility.*

5.2 Resource Allocation and Profit Maximizing Behavior in the Short Run

5.2.1 In a competitive market the equilibrium price of a commodity and the equilibrium quantity exchanged between buyers and sellers will be determined by the intersection of the demand and supply schedules.

> *Example. In Diagram 5.2.1(1) the equilibrium price of sandwiches is 40c. and the equilibrium quantity exchanged per time period is 90 sandwiches. The demand and supply curves are derived from the data in Table 5.2.1(1).*

Diagram 5.2.1(1) Market Demand and Supply Curves for Sandwiches in an American City

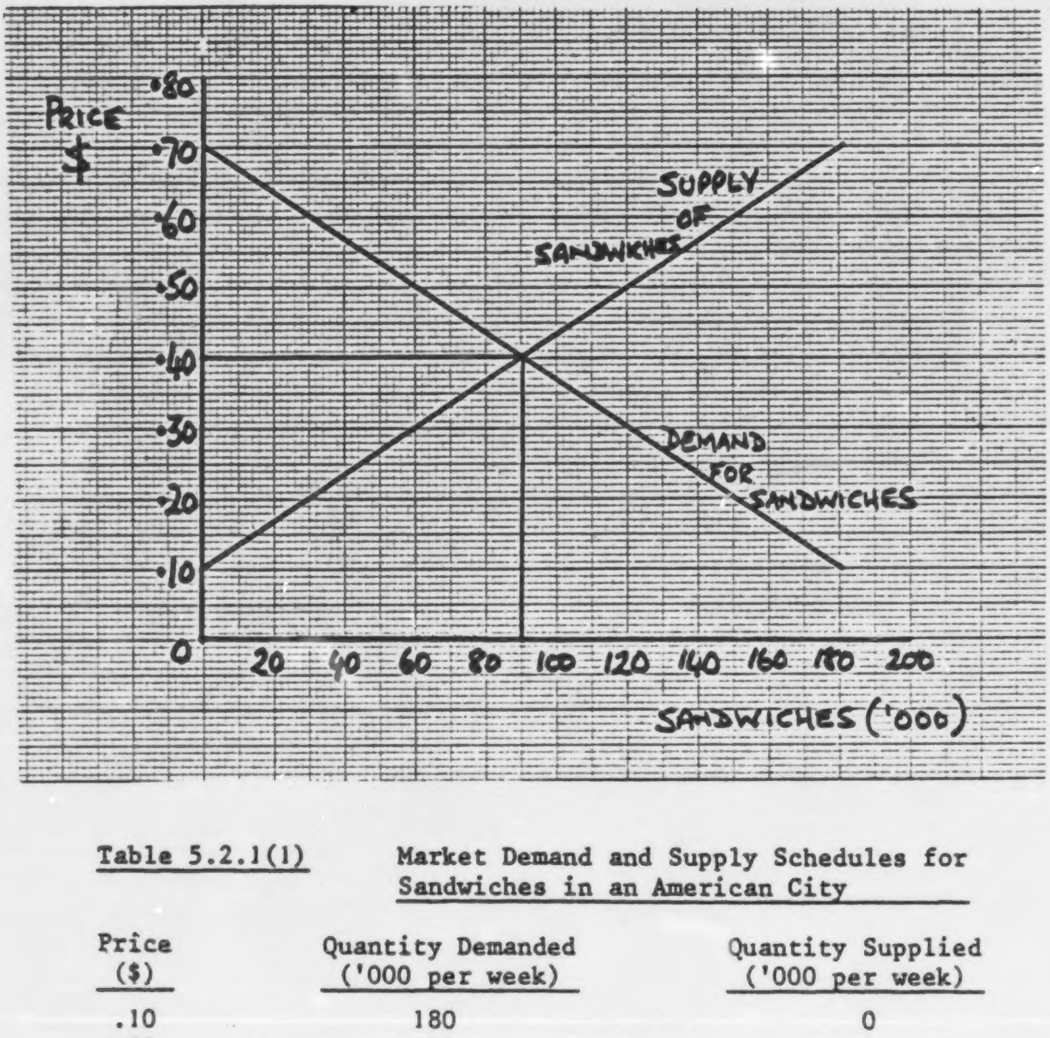


Table 5.2.1(1) Market Demand and Supply Schedules for Sandwiches in an American City

Price ($)	Quantity Demanded ('000 per week)	Quantity Supplied ('000 per week)
.10	180	0
.20	150	30
.30	120	60
.40	90	90
.50	60	120
.60	30	150
.70	0	180

5.2.2 The market demand curve for a commodity is the summation of individual demand curves (2.6.1) and the short run market supply curve is the summation of individual supply curves (marginal cost curves above the minimum point of the average variable cost curves) of the firms in the market (3.6.1). Each consumer and each firm is a price taker (3.3.4).

> *Example. In any large city the price of given quality hamburgers is determined by the demand for, and the supply of, hamburgers. If on some given day, one hamburger stall were to close and/or if one family decided to buy or not buy hamburgers, the price of hamburgers would not be affected by such actions.*

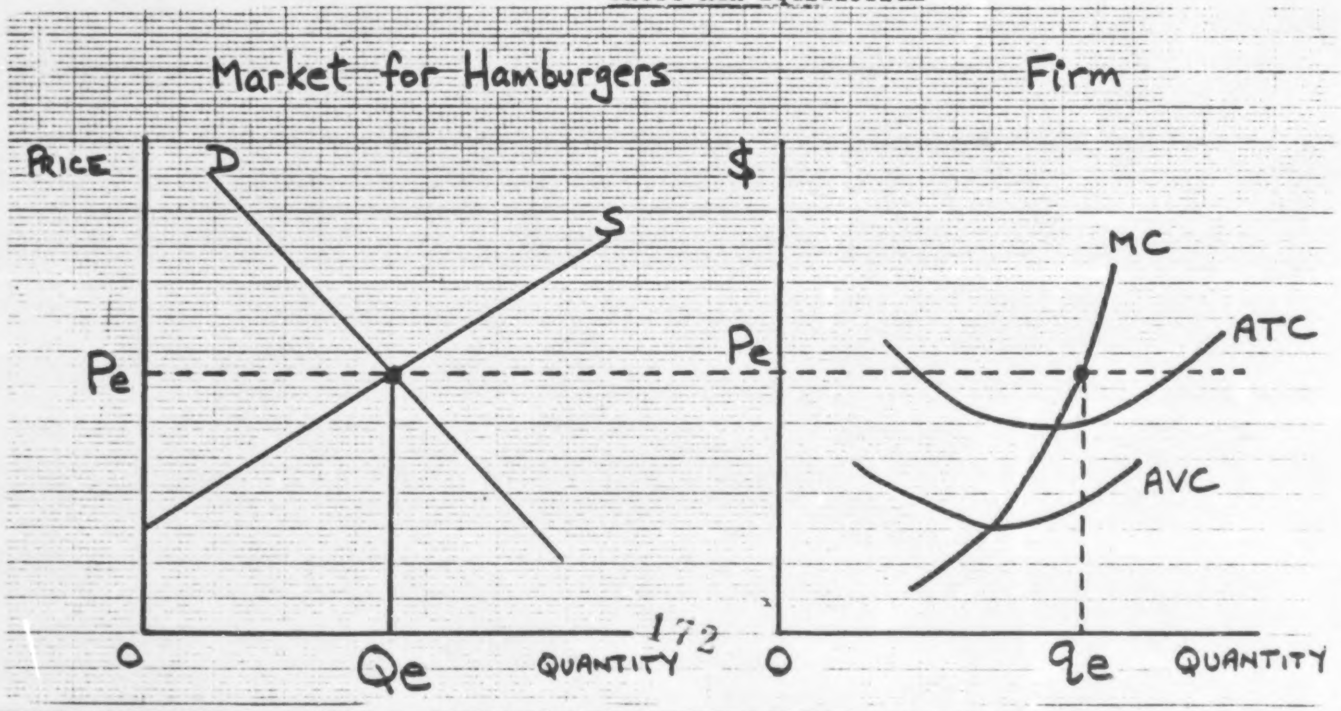
5.2.3 In the short run, a firm will produce output using both fixed and variable factor inputs. The firm in the short run will not be able to alter the amount of the fixed factor input but will be able to employ any number of units of the variable factor at the going price of that factor, i.e. in varying the amount of output in the short run the firm will employ different amounts of the variable factor in cooperation with a given amount of the fixed factor of production.

> *Example. If a hamburger stall operator wished, on a given day, to increase the number of hamburgers produced, he would be constrained by certain factors, e.g. the size of his stall, the size and number of grills and ovens in his stall, but he could hire more labor and buy more raw materials, e.g. meat, buns, onions.*

5.2.4 The profit maximizing firm in the short run will produce output until the marginal cost equals price (3.5.5).

> *Example. Diagram 5.2.4(1) shows the market for hamburgers and the output produced in the short run by one firm.*

Diagram 5.2.4(1) Market for Hamburgers and a Firm in Short Run Equilibrium



The firm is a price taker and its actions do not affect the equilibrium price of P_e. To maximize profit the firm will produce up to the point at which $P_e = MC$. This occurs at a firm output level of oq_e.

5.2.5 In a market, composed of competitive profit maximizing firms, the price of a product will equal short run marginal cost for each firm. Consequently, the price of a product will reflect the marginal cost to society of producing that product in the short run, i.e. given fixed factor inputs.

Example. In example 5.2.4 the number of hamburgers produced and sold in the market will be OQ which will consist of the summation of the oq_e's of all firms in the market. (Note each firm need not produce identical amounts in the short run, i.e. each firm while producing up to the point at which $p = MC$ does not guarantee identical outputs since different firms may have different amounts of fixed factors and consequently different MC's or supply curves (3.6.1)).

5.2.6 Since commodities are produced by competitive profit maximizing firms, for each commodity in the short run price will equal marginal cost, and since utility maximizing consumers will allocate their incomes until the ratio of marginal utilities to prices is equal for all commodities, the marginal equivalency condition will prevail and economic efficiency will exist in the economy in the short run, i.e. the price of each commodity will reflect the marginal cost to society of that commodity and societal utility could not be increased by any resource reallocation,

Example. The market for all commodities will be similar to the hamburger market of example 5.2.4. The price of beer will equal the marginal cost of beer just as the price of hamburgers will equal the marginal cost of hamburgers. Consumers will allocate their incomes on beer and hamburgers until the ratios of marginal utilities to prices are equal

The marginal equivalency condition will hold for all commodities,

$$\text{i.e.,}\ \frac{MU_A}{MC_A} = \frac{MU_B}{MC_B} = \ldots\ldots\ldots\ldots\ldots\ldots = \frac{MU_Z}{MC_Z}$$

5.2.7 If, in the short run, an event occurs which causes the equilibrium prices and quantities exchanged of commodities to alter, the utility maximizing behavior of consumers and profit maximizing behavior of firms will establish new equilibrium prices and quantities. The marginal equivalency condition will be re-established and economic efficiency will again prevail.

Example. If, in a beer - coffee world represented by normally shaped demand and supply curves, a dramatic cold spell of weather causes the demand curve for beer to shift to the left and the demand curve for hot coffee to shift to the right, the price of beer and the quantity exchanged will decrease and the price of hot coffee and quantity exchanged will increase. Variable factors of production will be reallocated from the beer market to the coffee market until prices equal marginal costs for each firm in the markets. At the same time consumers will reallocate their expenditures until the ratios of marginal utilities to prices for beer and coffee are again equal. Societal utility will be at a maximum and any further resource and income reallocation would decrease total utility.

5.3 Resource Allocation and Profit Maximizing Behavior in the Long Run

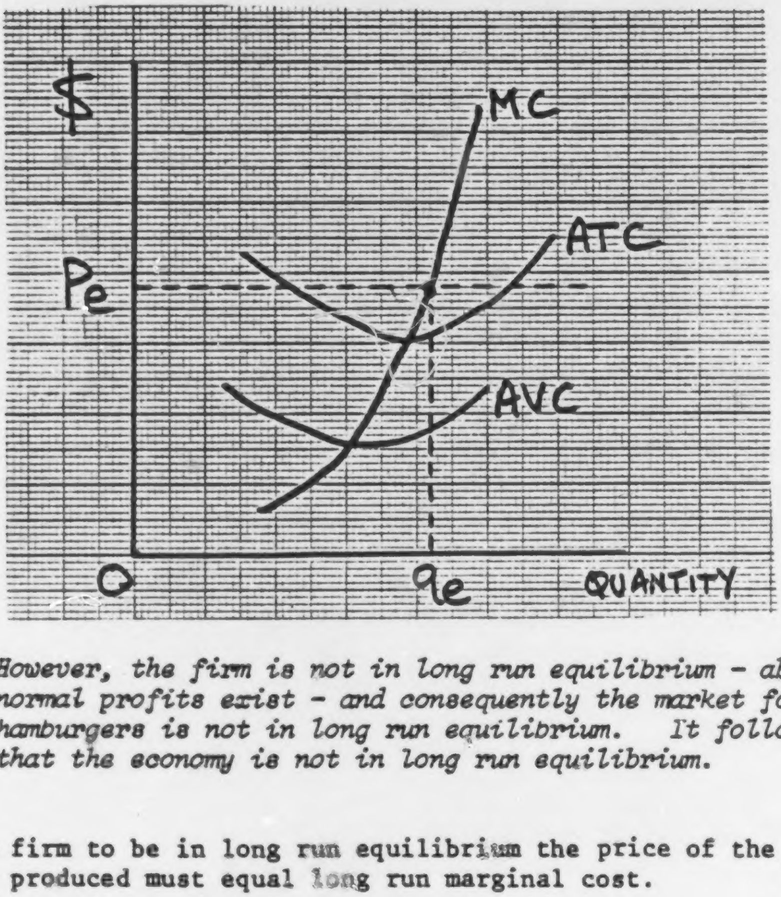
5.3.1 For economic efficiency to prevail in the long run in a market economy the marginal equivalency condition must hold, i.e.

$$\frac{MU_A}{MC_A} = \frac{MU_B}{MC_B} = \ldots\ldots\ldots\ldots\ldots\ldots\ldots = \frac{MU_Z}{MC_Z}$$

However, in the long run the relevant marginal cost of each commodity is the long run marginal cost.

Example. In the hamburger example depicted in 5.2.4 and reproduced below, the firm is in short run equilibrium producing output oq_e *whose price = MC (short run).*

Diagram 5.3.1(1) A Firm in Short Run Equilibrium

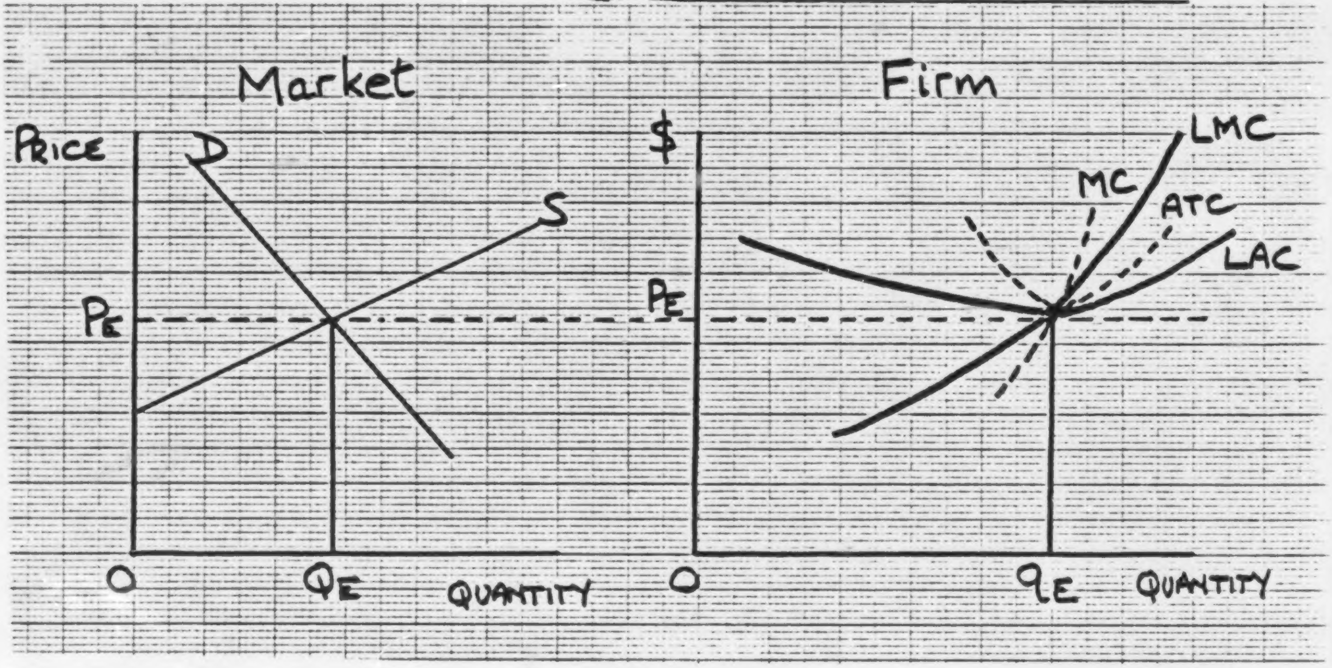


However, the firm is not in long run equilibrium - above normal profits exist - and consequently the market for hamburgers is not in long run equilibrium. It follows that the economy is not in long run equilibrium.

5.3.2 For a firm to be in long run equilibrium the price of the commodity being produced must equal long run marginal cost.

Example. Diagram 5.3.2(1) shows the market for hamburgers and the output produced in the long run by one firm.

Diagram 5.3.2(1) **Market for Hamburgers and a Firm in Long Run Equilibrium**



The firm, as in the short run depicted in 5.2.4, is a price taker. In long run equilibrium the firm's plant size will be that depicted by ATC. Its output will be oq_E. *Price will equal LMC. Price will equal also MC, minimum ATC and minimum LAC.*

5.3.3 For an economy to be in long run equilibrium the prices of all commodities produced must equal their long run marginal costs.

Example. When all firms in a market economy are in long run equilibrium the price of each commodity will reflect the societal marginal cost of producing that commodity and any increase or decrease in either or both the variable and fixed factors of production would increase the per unit cost of that commodity.

5.3.4 For an economy to be in long run equilibrium the ratio of marginal utilities to prices for all commodities must be equal.

Example. No consumer in the economy could increase total utility by reallocating income from one commodity to another.

5.3.5 When an economy is in long run equilibrium, i.e. when

$$\frac{MU_A}{MC_A \text{ (long run)}} = \frac{MU_B}{MC_B \text{ (long run)}} = \dots\dots\dots\dots = \frac{MU_Z}{MC_Z \text{ (long run)}}$$

societal utility will be maximized and each firm will be earning normal profits by producing output where LAC and ATC are minimal, and price equals LMC and MC. Any reallocation of resources would reduce societal utility.

5.4 The Wonderful World of Adam Smith vs. the Real World

Adam Smith, an 18th century Scottish economist, formalized the main elements of Units 1-5 and showed how the utility seeking behavior of consumers and profit maximizing behavior of firms would tend to lead to an efficient solution of the fundamental problem faced by a nation of unlimited wants and scarce resources. He pointed out that no large group of planners, a scarce resource, was needed to reach a solution that would tend to be economically efficient. He pointed out also, however, that market forces would not guarantee economic efficiency under all circumstances, that collective action or planning would be necessary in certain areas of economic activity and that while market forces in many areas would tend to produce an economically efficient resource allocation there were many forces at work which would prevent the ideal from being reached.

5.4.1 It cannot be stated unequivocally that a competitive market economy will be efficient and will produce that combination of commodities most in accordance with consumers' wishes using the smallest possible quantity of resources. There are several reasons.

5.4.1.1 New goods and services are constantly appearing in the real world just as old goods and services are constantly disappearing. This situation can prevent firms from reaching long run equilibrium.

> *Example. The invention of the automobile signalled the end of the life of the horse-drawn buggy just as the steam-ship spelt the death knell for the sailing vessel as the principal means of transporting cargoes and passengers at sea.*

5.4.1.2 While firms will attempt to reach long run equilibrium in order to maximize profit, rapid technological change within an industry can make existing plant and equipment (fixed factors) obsolete and prevent the attainment of long run equilibrium.

> *Example. The arrival of the jet engine necessitated larger runways at airports. The increasing demand for air travel led to reorganization of existing, and construction of new, airports. Because of the time lags involved in recognizing such needs, making necessary plans and carrying out the needed work, many airports were completed in time to discover that further technological change resulting in the 747 jumbo jets made the new airports obsolete and that further change was required immediately to attain economic efficiency.*

5.4.1.3 Changes in factor supplies and factor prices can make efficient long term planning for firms difficult and may prohibit the achievement of long term equilibrium.

Example. The OPEC oil embargo and subsequent dramatic increase in the world price of oil caused both consumers and firms to change methods of transportation, heating and production. Many consumers in the U.S. when faced with long queues for gasoline ordered small automobiles. The major U.S. automobile producers retooled some of their plants (fixed factor of production) and started producing small automobiles. When oil became more plentiful consumers' demand increased for larger automobiles and decreased for the smaller automobiles, leaving thousands of unsold small automobiles in Detroit.

5.4.1.4 Technological change, by reducing the input requirements for the production of a good, makes possible a larger amount of total output in a society with a concomitant increase in total utility. However, the more rapid the technological change in an industry the smaller the probability of firms achieving long run equilibrium.

Example. In the past two decades the rate of technological change in the electronics industry has been extremely rapid. Pocket calculators have decreased steadily in price despite the rapidly growing demand. Engineering breakthroughs have increased the capabilities of these calculators and many new firms have entered this rapidly growing industry. While such rapid and dramatic changes continue to occur the achievement of long run equilibrium is impossible.

5.4.1.5 Changes in consumers' tastes and preferences, changes in population and the movement of people and firms from one geographical area to another, cause profit maximizing firms to move resources from one industry to another and from one geographical area to another. The more rapid the changes the less the chance firms have to reach long run equilibrium though profit maximizing behavior dictates that they attempt to do so.

Example. The change in dress style of the college age population has led to changes in firms' outputs, and the increase in demand for college places in the past two decades has led to many resources being allocated to building new universities and colleges in different parts of the country and producing the necessary teaching inputs. It has been predicted that the demand will decrease in the early 1980's and excess capacity will exist in many college campuses. If this situation occurs the college/university industry will have to contract to achieve equilibrium.

5.4.2 While the reasons for not achieving economic efficiency in the long run enumerated in 5.4.1 are concerned with the changing nature of many factors in the real world, there are other reasons why a market system will not achieve economic efficiency in both the short run and long run. Micro Units 6, 7 and 8 identify the factors which can prevent the achievement of economic efficiency and analyze how collective action can overcome such factors and bring about economic efficiency.

MICRO UNIT 6

ORGANIZATION OF INDUSTRIES

6.1 Characteristics of Firms

6.2 Perfect Competition

6.3 Monopolies and Economies of Scale

6.4 Imperfect Competition

6.5 Regulation and Economic Efficiency

6 ORGANIZATION OF INDUSTRIES

6.1 Characteristics of Firms

6.1.1 A necessary condition for achieving economic efficiency is that price must equal marginal cost for each good and service produced. The realization of this equality depends upon:

1. The structure of industries
2. The behavior and performance of firms.

6.1.2 The structural features of an industry are the number and relative size of firms producing a good or service in a market, the degree of similarity between the output of different firms in a market, and the ease with which resources can move into or out of an industry.

> *Example. The structural characteristics of the wheat-producing industry and the automobile industry in the USA are different. There is a large number of wheat farmers each producing an identical good, and any US citizen who wishes to become a wheat farmer can do so simply by hiring the necessary resources. In contrast, the automobile industry contains three large firms - General Motors, Ford and Chrysler - which produce over 90% of all US automobiles and whose outputs (i.e. automobiles) are similar but not identical. Apart from a few small firms which specialize in the manufacture of particular types of automobile, e.g. sports coupes, the three large automobile producers have dominated the US domestic market for decades. The only new entrants of significant size have come from abroad, e.g. the Japanese firms of Toyota and Datsun.*

6.1.3 The structural features of an industry largely determine how every individual firm in that industry behaves with respect to price and output.

> *Example. There are significant differences in the price and output behavior of firms in the wheat industry and firms in the automobile industry. Wheat farmers are price takers, the price being determined by market forces of demand and supply. Individual automobile producers, however, have power to affect the price at which their automobiles sell in the market. Unlike wheat farmers, each can influence the demand for its goods by advertising and affect the demand for the output of its competitors.*

6.1.4 The structural features of a market together with the output behavior of firms determine standards of performance which affect the pattern of resource allocation.

Example. From the viewpoint of economic efficiency it is necessary to know whether an industrial organization, as exemplified by the wheat industry or by the automobile industry, will lead to the prices of the goods or services produced reflecting the marginal cost to society. If prices are not equal to marginal costs, the marginal equivalency conditions will not prevail and economic efficiency will not be achieved.

6.1.5 **The prevalent forms of industrial organization in the market economy are perfect competition, monopoly, imperfect competition, and oligopoly.**

6.2 Perfect Competition

6.2.1 The number of firms in a perfectly competitive industry is so large that each individual firm's actions has a negligible effect on price of the commodity and quantity exchanged in the market.

Example. The US wheat industry is composed of a large number of wheat farmers. Although some wheat farmers are larger than others in terms of land cultivated and wheat produced, no individual wheat producer - not even the largest - accounts for a significant proportion of the total quantity of wheat produced in the US. The withdrawal or addition of one wheat farmer would have a negligible impact on the market price of wheat in the USA and in the quantity exchanged.

6.2.2 All firms in the industry produce an identical good. There is no real or imagined difference between each unit of output produced by one firm and each unit of output produced by all other firms (3.3.5).

Example. Wheat is bought and sold in large markets, often national and international in scale, and buyers cannot distinguish wheat by farm of origin within the US.

6.2.3 There are no restrictions on resource owners moving into or out of the industry.

Example. Any US citizen who aspires to become a wheat farmer can do so provided he commands the necessary resources to enter the industry.

6.2.4 Firms attempt to maximize profit both in the short run and in the long run.

Example. Each individual wheat farmer, whether making a short run or long run decision, will hire that combination of factor inputs, and combine them in an engineering efficient manner, which produces that level of output which is calculated to generate maximum profit.

6.2.5 Resource owners have perfect information on the opportunity cost of all resources.

Example. A profit maximizing wheat farmer must know the return he would receive on the resources he commands not only if they were employed in different areas of agriculture, but also if employed in any other activity, e.g. the use of the land as a golf driving range instead of a wheat farm.

6.2.6 **Each firm in perfect competition faces a perfectly elastic demand curve, meaning that the firm can sell all the output it wishes to produce at a single price, i.e. the market price.**

Example. In 3.5 the example of mackerel supply assumed that the industry was perfectly competitive and that the equilibrium price of mackerel in the market was $5 per kilo. Diagram 6.2.6(1) illustrates the market for mackerel and the demand curve facing an individual supplier of mackerel.

Diagram 6.2.6(1): The Market for Mackerel and the Demand Curve facing a Firm

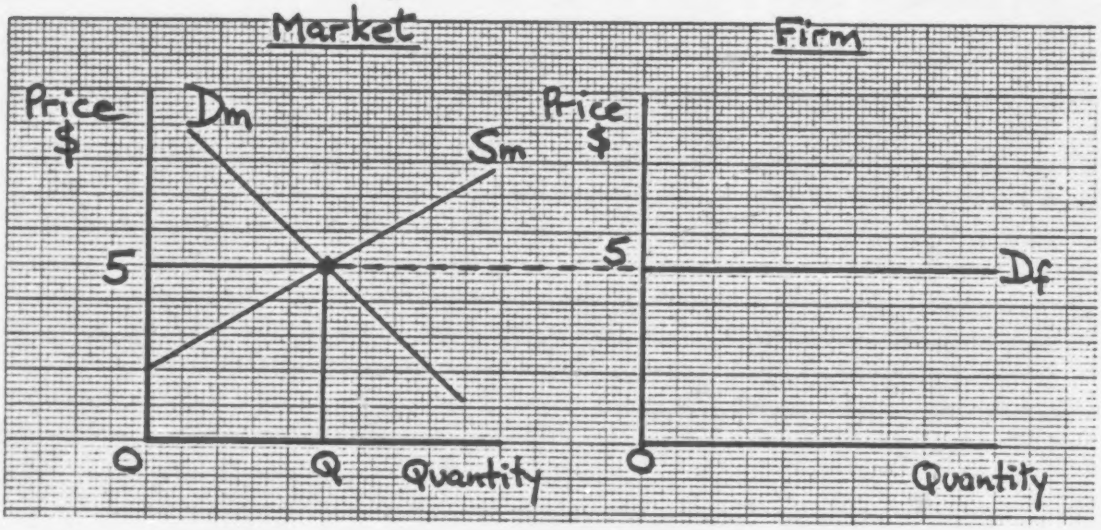


Diagram 6.2.6(1) shows how, with normally sloped market demand (D_m) and supply (S_m) curves, the equilibrium price of mackerel would be $5 per kilo and the equilibrium quantity OQ kilos. Since the catch of each individual firm is so small in relation to the total market output, $5 per kilo is the price at which it is able to sell all the mackerel it catches. This is shown in Diagram 6.2.6(1) in which Df denotes the individual firm's demand curve. The demand curve faced by the firm in perfect competition is, therefore, perfectly elastic.

6.2.7 Since the firm is a price taker, the revenue it receives from each unit of output must be the same, i.e. average revenue is constant and equal to price. Since the revenue obtained by the firm from each additional unit of output must also be the same, marginal revenue is also constant and equal to price. Consequently, the demand schedule faced by the firm is both its average revenue schedule and its marginal revenue schedule.

Example. Table 6.2.7(1) is based on the mackerel example of 3.5.5. It shows the total revenue, average revenue and marginal revenue obtained at different levels of output.

Table 6.2.7(1): The Firm's Total, Average and Marginal Revenue Schedules under Perfect Competition

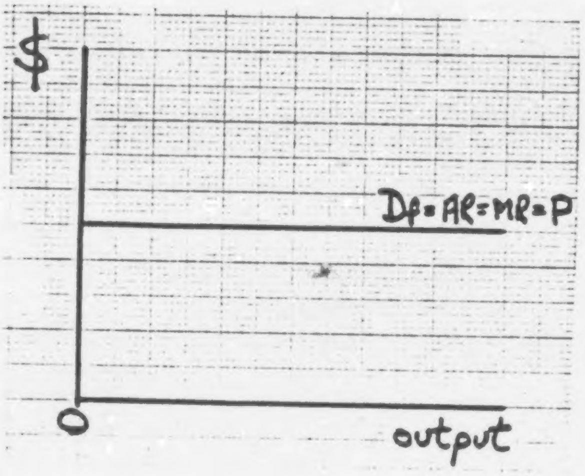
Output (kilos)	Price per kilo ($)	Total Revenue (Q x P) ($)	Average Revenue ($\frac{TR}{Q} = P$) ($)	Marginal Revenue ($\frac{\Delta TR}{\Delta Q} = P$) ($)
0	5	0	-	-
50	5	250	5	5
100	5	500	5	5
150	5	750	5	5
200	5	1000	5	5
250	5	1250	5	5
300	5	1500	5	5
350	5	1750	5	5
400	5	2000	5	5

Average revenue (AR) $= \frac{total\ revenue}{quantity}$*, but since total revenue = quantity x price, average revenue* $= \frac{quantity \times price}{quantity}$ *= price.*

Marginal revenue (MR) $= \frac{\Delta TR}{\Delta Q}$*, and since* $\Delta TR = \frac{\Delta Q \times \Delta P}{\Delta Q}$*, marginal revenue =* ΔP*. But since the firm sells all the output it wishes at the market price, marginal revenue = price.*

Diagramatically, the demand curve facing a perfectly competitive firm is therefore also its average revenue curve and its marginal revenue curve, as shown in Diagram 6.2.7(1)

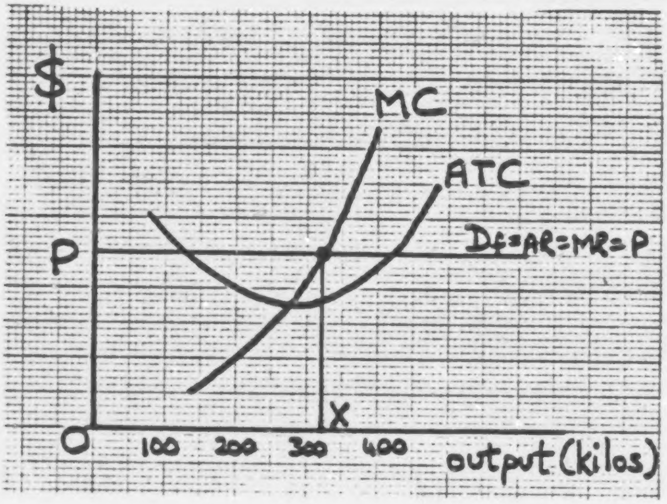
Diagram 6.2.7(1): Demand, Average Revenue and Marginal Revenue Curve for a Perfectly Competitive Firm



2.8 Given a set of revenue schedules as outlined in 6.2.7, and a set of cost schedules as outlined in 3.4, a firm will maximize profit in the short-run by producing that level of output at which marginal revenue equals short-run marginal cost (3.5.5).

Example. The output level which yields the maximum profit for a perfectly competitive firm in the short-run is illustrated in Diagram 6.3.1(1), based on the mackerel example developed in 3.5.5.

Diagram 6.2.8(1): Profit Maximization for a Perfectly Competitive Firm in the Short-Run

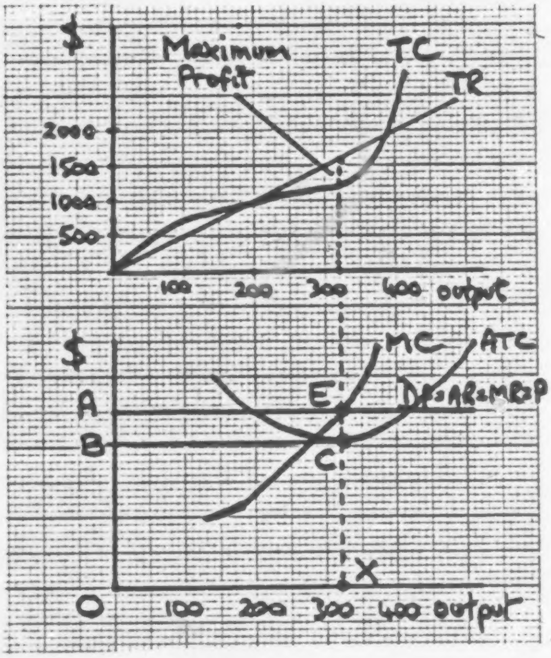


To ensure equality of marginal cost and marginal revenue an output level of OX - approximately 320 kilos - would be produced. If the firm were to produce more than 320 kilos, marginal cost would exceed marginal revenue and consequently the firm could increase profit by lowering output. Conversely, if the firm were to produce less than 320 kilos, marginal revenue would exceed marginal cost and the firm would add more to revenue than to cost, i.e. increase profit, by increasing output. Only when marginal cost and marginal revenue are equal would profit be maximized.

2.9 If the output level which ensures maximum profit is such that price is greater than average cost, the firm will be earning profit above the normal returns to factors which constitute the average cost curve (3.5). Since perfectly competitive firms are price takers in factor markets as well as in goods markets, average cost at any output level reflects the normal returns to such factors. If at any level of output total revenue exceeds total cost, i.e. average revenue (price) exceeds average cost, some factors are earning above normal returns.

Example. The level of output which ensures maximum profit can be found both by comparing total revenue and total cost, and marginal revenue and marginal cost as illustrated in Diagram 6.2.9(1).

Diagram 6.2.9(1): Maximum Profit Position for a Perfectly Competitive Firm in the Short-Run



The largest difference between total revenue and total cost, i.e. maximum profit, occurs at an output level of approximately 320 kilos. By definition, at this output level marginal revenue equals marginal cost, i.e. point E.

At this output level, however, the firm is earning above normal profit since price (average revenue) exceeds average cost. The price at which each kilo of mackerel is sold is measured by XE, whereas the average cost of producing 320 kilos of mackerel is XC. Hence the firm is earning above normal profit of EC on each kilo of mackerel sold. The total amount of above normal profit obtained by producing 320 kilos of mackerel is denoted by the shaded area AECB - the quantity of mackerel sold (OX = AE) x profit per unit (EC).

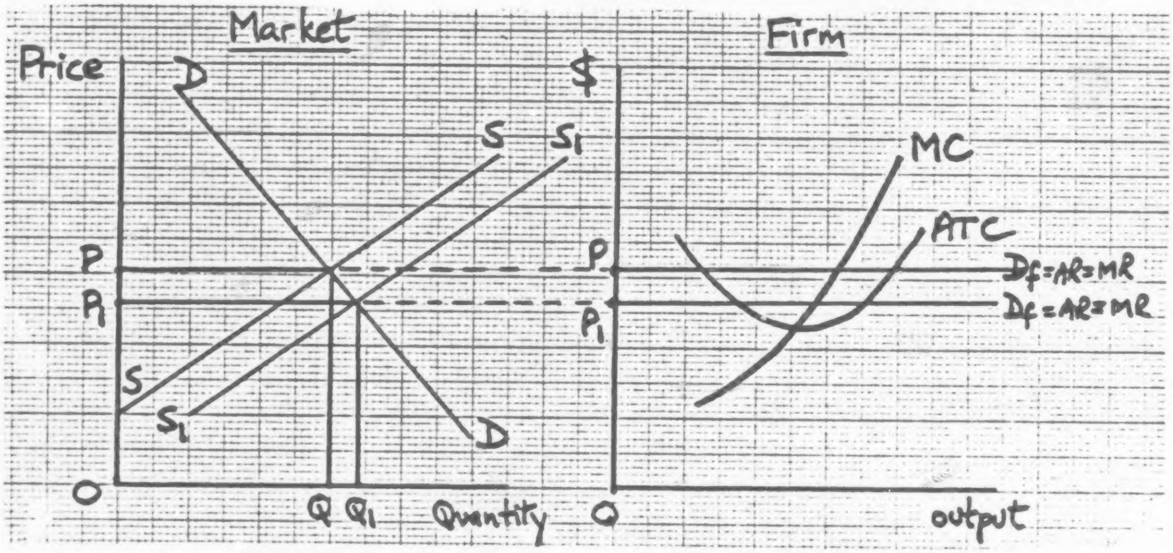
6.2.10 If above normal profit exists in an industry, resources will flow into that industry. Conversely, if less than normal profit exists in an industry, resources will flow out of that industry.

Example. In a market economy, the existence of different rates of profit in different industries acts as an incentive for resources to transfer out of low and declining profit sectors into high profit sectors. In the US, for example, because of high profit earned in the electronics industry, many firms have expanded their output and many new firms have entered the industry. Conversely, after the initially high profit earned in the early days of the gold rush, resources moved out of the industry as profit fell.

6.2.11 Given above normal profit (less than normal) in an industry, resources will flow into (out of) that industry in the expectation that such profit will continue to be earned by resources in that industry. As resources move in (out) firms as a whole will be prepared to supply a greater (lower) quantity at each price. *Cet. par.* the equilibrium price of the good will fall (rise) and the equilibrium increase (decrease). This movement of resources will continue until the forces causing it are neutralized, i.e. when no resources can earn a higher return by moving from one industry to another. When this occurs, each firm will be in long-run equilibrium, and price will equal long-run marginal cost.

Example. Suppose the market for mackerel is initially represented by the demand curve DD and the supply curve SS, and that the equilibrium price and equilibrium quantity are OP and OQ respectively, as shown in Diagram 6.2.11(1). Suppose also that at the equilibrium price of OP, above normal profit is earned by firms in the industry.

Diagram 6.2.11(1): Effect on Equilibrium Price of a Good when Resources Move into an Industry



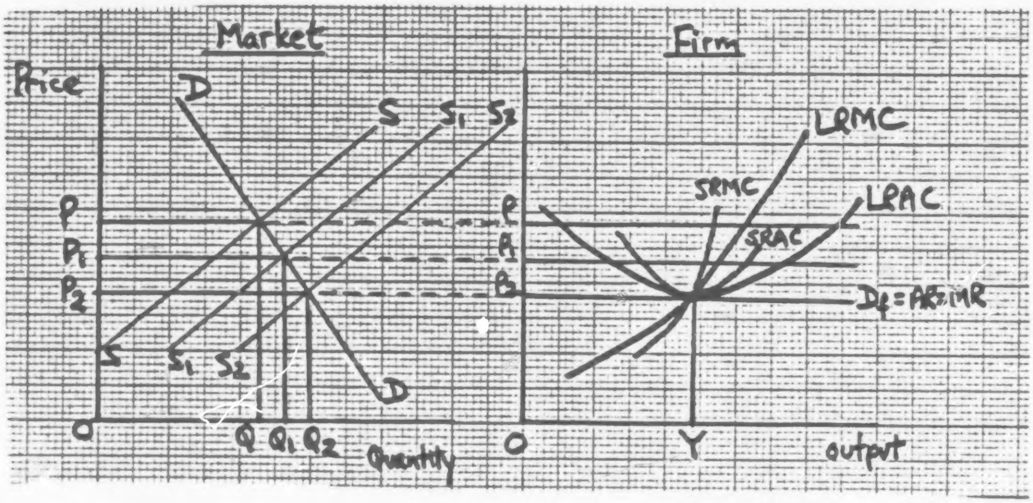
Resources will be attracted into the mackerel industry in response to the level of above normal profit, and can be illustrated diagrammatically by a shift of the supply curve from SS to SS$_1$. As a result, equilibrium price falls from OP to OP$_1$, and equilibrium quantity increases from OQ to OQ$_1$.

Given that firms are price takers, as equilibrium price falls so too does average revenue (price) and marginal revenue for each firm in the industry. As shown in Diagram 6.2.11(1) as equilibrium price falls from OP to OP$_1$ the price (demand curve = AR = MR) facing the individual firm also falls from OP to OP$_1$.

However, as long as above normal profit is being earned in the mackerel industry resources will continue to flow into the industry. This incentive to move resources into the industry will cease when, for the individual firm, price equals average *cost at which point normal returns to resources employed in the industry will exist.*

As shown in Diagram 6.2.11(2), resources will stop flowing into the industry when price falls to OP_2. *The firm maximizes profit by equating long-run marginal cost with marginal revenue and producing output OY. At this output level, price (average revenue)* OP_2 *is equal to minimum long-run average cost and also to long-run marginal cost. Only normal profit is earned. Hence the firm would be in long-run equilibrium by producing OY kilos of mackerel.*

Diagram 6.2.11(2):



6.2.12 Given utility-maximizing consumers, an economy containing perfectly competitive industries would achieve economic efficiency. Since utility-maximizing behavior requires that the ratio of $\frac{\text{Marginal Utility}}{\text{Price}}$ is equal for all goods, and since profit-maximizing behavior ensures that Price = Marginal Cost for all goods, economic efficiency would be achieved since the ratio of $\frac{\text{Marginal Utility}}{\text{Marginal Cost}}$ for all goods would be equal.

Example. When consumers achieve equilibrium, i.e. maximize utility from the allocation of their budget on a range of goods and services, $\frac{MU}{P}$ *is the same for every good they buy.*

For two goods, say mackerel and hamburgers, (m and h),
$\frac{MUm}{Pm} = \frac{MUh}{Ph}$.

Also, given perfectly competitive conditions in the mackerel and hamburger industries, in equilibrium $Pm = MCm$, *and* $Ph = MCh$.

Therefore, $\frac{MUm}{MCm} = \frac{MUh}{MCh}$

6.3 Monopolies and Economies of Scale

6.3.1 **A monopolist is a producer who supplies the complete market for a good or service.**

Example. For much of the twentieth century in the US aluminum production from virgin ore was controlled by only one firm, the Aluminum Company of America (Alcoa). The aircraft industry, the major user of aluminum, had to purchase this metal from Alcoa. In local, as opposed to national, markets monopolies may exist. In small, isolated towns the only gasoline station or hotel is a local monopoly.

6.3.2 **A barrier or barriers to entry may legally prohibit new firms from entering the market, and/or economic disincentives may discourage potential entrants.**

Example. Barriers may take the form of patents. For many years the Xerox Corporation had a patent for the Xerox photocopying machine which guaranteed the firm exclusive use of the photocopying process embodied in each xerox machine. Leading pharmaceutical companies also have patents for many of the drugs they produce. A disincentive to enter a market may exist because of market conditions. For example, in a small isolated town there may be only one gasoline station which supplies gasoline to all automobile owners in the town. There would be a disincentive for any other individual to open another gasoline station in the town unless he could quickly capture the whole local market for gasoline and displace the existing firm.

6.3.3 Since a monopolist is the sole producer of a good or service, the monopolist's short run marginal cost curve is the market supply curve. Also, the market demand curve for the good or service is the demand curve faced by the monopolist.

Example. Suppose a drug company had a patent on a certain tranquiliser, guaranteeing the company sole rights of production. The market demand curve for the tranquiliser - relating the quantities that all buyers would wish to purchase at different prices - would be the demand curve faced by the company. Similarly, the company's short-run marginal cost curve - relating the change in total cost required to produce different levels of output - would be the industry supply surve.

6.3.4 Since the monopolist faces a downward sloping demand curve, there will be a divergence between average revenue (price) and marginal revenue.

Example. Suppose the drug company referred to in 6.3.3 faces a demand schedule as illustrated by columns (1) and (2) in Table 6.3.4(1).

Table 6.3.4(1): Demand and Total, Average and Marginal Revenue under Monopoly

(1) Price ($)	(2) Quantity Demanded (kilos per day)	(3) Total Revenue ($)	(4) Average Revenue ($)	(5) Marginal Revenue per kilo ($)
18	0	0	-	
				16
16	100	1600	16	
				12
14	200	2800	14	
				8
12	300	3600	12	
				4
10	400	4000	10	
				0
8	500	4000	8	
				-4
6	600	3600	6	
				-8
4	700	2800	4	
				-12
2	800	1600	2	

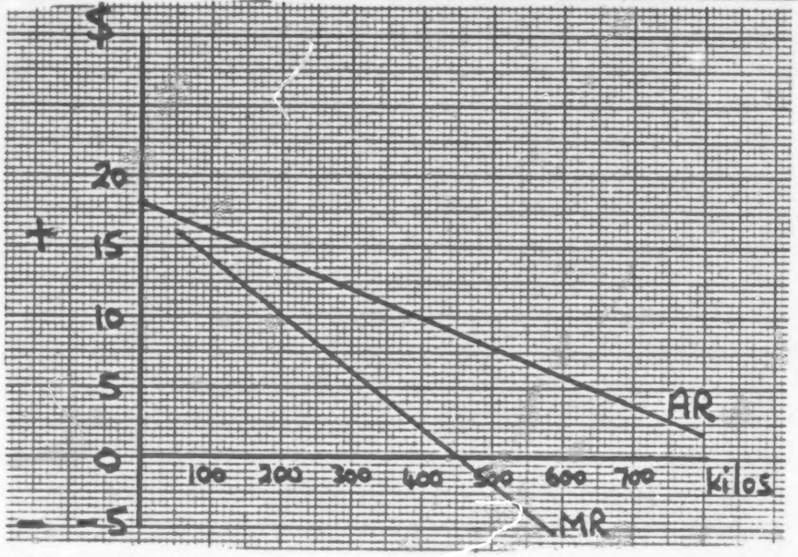
Marginal revenue is less than average revenue for all levels of demand. When average revenue decreases marginal revenue decreases at a greater rate. When average revenue increases, marginal revenue increases at a faster rate. Suppose the drug firm were selling 300 kilos per week at a price of $12 per kilo. Total revenue would be $3600. In order to sell 400 kilos per week, price would have to be $10 per kilo. Total revenue from 400 kilos per week would be $4000. The marginal revenue per unit as sales increase from 300 to 400 kilos is $4 $\frac{(\$4000 - £3600)}{100}$, while the price per kilo of 400 kilos is $10, i.e. marginal revenue is less than average revenue.

The reason for this divergence lies in the fact that as sales increase from 300 to 400 kilos per week, the price becomes $10 per kilo not only for the extra 100 kilos but also for the remaining 300 kilos. By selling the extra 100 kilos the monopolist receives additional revenue of $1000 (i.e. 100 x $10); however, since the price of the remaining 300 kilos falls from $12 to $10 each, i.e. by $2, the net addition to total revenue i.e. marginal revenue is:

$1000 - (300 x $2) = $400, or $4 per kilo.

The average revenue and marginal revenue curves for the monopolist based on the schedules in Table 6.3.4(1) are shown in Diagram 6.3.4(1).

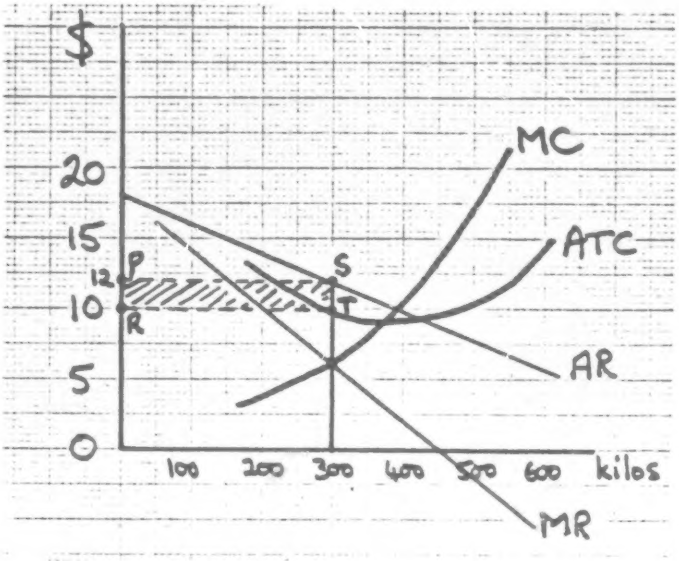
Diagram 6.3.4(1): Average and Marginal Curves under Monopoly



6.3.5 A monopolist will adopt the same decision rule for choosing the maximum profit output level as would a perfectly competitive firm, i.e. produce up to the level of output at which marginal cost equals marginal revenue.

Example. Suppose the drug firm is faced with similar short-run average total cost and short-run marginal cost curves to a perfectly competitive firm. The short-run profit maximization position is shown in Diagram 6.3.5(1) in which the monopolist's average revenue and marginal revenue curves are superimposed on the average total cost and marginal cost curves.

Diagram 6.3.5(1): Short-Run Profit Maximization for a Monopolist



The output level at which marginal cost equals marginal revenue is 300 kilos per day. Knowing the maximum profit output level the monopolist will charge the price at which this output will sell in the market. From the demand curve, $12 per kilo is the price consumers would be willing to pay for 300 kilos per day.

From the average cost curve, the unit cost of producing 300 kilos per day is denoted by QT, i.e. $10 per kilo. Thus in the short-run, the price per unit received by the monopolist exceeds the average total cost of production by $200 per kilo, i.e. the average profit per unit is $2.

Total revenue from selling 300 kilos per day is given diagrammatically by OQ (300 kilos) x OP ($12 per kilo), i.e. the area OQSP = $3600. Total cost incurred by producing 300 kilos per day is given by OQ (300 kilos) x QT ($10 per kilo), i.e. the area OQTR = $3000. Thus the monopolist's profit is denoted by the area PSTR = $600 = profit per unit ($2) x output (300 kilos). This is the maximum profit the monopolist can earn, given the cost and revenue conditions under which he operates. When the monopolistic firm produces 300 kilos per week it will be in equilibrium.

6.3.6 Although above normal profit is earned by a monopolist in short-run equilibrium, there will be no tendency for profit to be competed away in the long-run by the entry of new firms to the market.

Example. Since the drug firm's production of the tranquilizer is protected by a patent, no other firm may manufacture that drug. Hence no new firms can enter the market and compete against the existing firm. Unlike perfect competition, in the long run the monopolist's price, and hence above normal profit, cannot be affected by the entry of new firms into the industry.

6.3.7 In the long run the monopolist may expand or contract his output by adjusting his plant size. Whether he expands or contracts output depends on the relation between long run marginal cost (LRMC) and marginal revenue (MR). If LRMC is less than MR the monopolist will increase output. Conversely, if LRMC exceeds MR, the monopolist will decrease output. In either case above normal profit will be higher in the long run than in the short run.

Example. Although the drug firm is in short run equilibrium when producing 300 kilos per week, it may not be in long run equilibrium. If, for example, the marginal revenue gained by selling more than 300 kilos per week exceeded the long run marginal cost of producing more than 300 kilos per week, the drug firm could increase profit by increasing output. This would involve adjusting its plant size to produce more than 300 kilos per week. If, however, by producing 300 kilos per week long run marginal cost exceeded marginal revenue, the firm again would not be in a long run profit maximizing *position. The firm could increase profit by decreasing output and adjusting its plant size to produce output of less than 300 kilos per week.*

6.3.8 The monopolist will maximize profit in the long run, i.e. will be in long run equilibrium, when he produces that level of output at which long run marginal cost equals marginal revenue. Since, under monopoly, marginal revenue is less than average revenue, price will exceed marginal cost, i.e. $Pm > MCm$.

> *Example. Given that marginal revenue is less than average revenue under monopoly, as shown in Diagram 6.3.5(1), by equating marginal cost with marginal revenue (either in the short run or in the long run) the profit maximizing monopolist will produce an output level where price is greater than its marginal cost.*

6.3.9 When monopoly exists in an economy, economic efficiency will not prevail. The marginal equivalency conditions for economic efficiency specify that the ratios of marginal utility to marginal cost, i.e. $\frac{MU}{MC}$, must be equal for all goods and services. This will be achieved when the ratios of $\frac{MU}{P}$ are equal and when $P = MC$ for all goods and services. Under monopoly, however, price is greater than marginal cost. Thus the marginal equivalency conditions cannot be met, since marginal cost cannot be substituted for price in the equivalency equation. The ratio of $\frac{MU}{MC}$ for the monopolist's good will be greater than the ratio of $\frac{MU}{MC}$ for competitively produced goods since, for each good produced under monopolistic conditions $P > MC$.

Consequently it would be possible to increase society's utility by reallocating resources so that more of the monopolist's good and fewer of other goods were produced.

> *Example. Suppose there are two goods, A and B, in an economy and that A is produced under monopoly conditions while B is produced under competitive conditions. Suppose also that for good A,* $\frac{MU_A}{MC_A} = \frac{4}{2}$ *and for good B,* $\frac{MU_B}{MC_B} = \frac{3}{2}$
> *The marginal equivalency conditions are not met because the price of good A would be above its marginal cost. Consumers could become better off if resources were shifted from the production of B to the production of A. If, for example, \$2 worth of resources were shifted from the production of B to the production of A one less unit of B would be produced since* $MC_B = \$2$. *As a result, consumers will lose 3 units of utility from the decrease in production of B. Because, however,* $MC_A = 2$, *the resources transferred from B will result in one more unit of A being produced. This will increase*

consumer utility by 4 units. Hence consumers would receive a net gain of 1 unit of utility by reallocating resources in this way. Consumers would become no better off only when $\frac{MU_A}{MC_A} = \frac{MU_B}{MC_B}$.

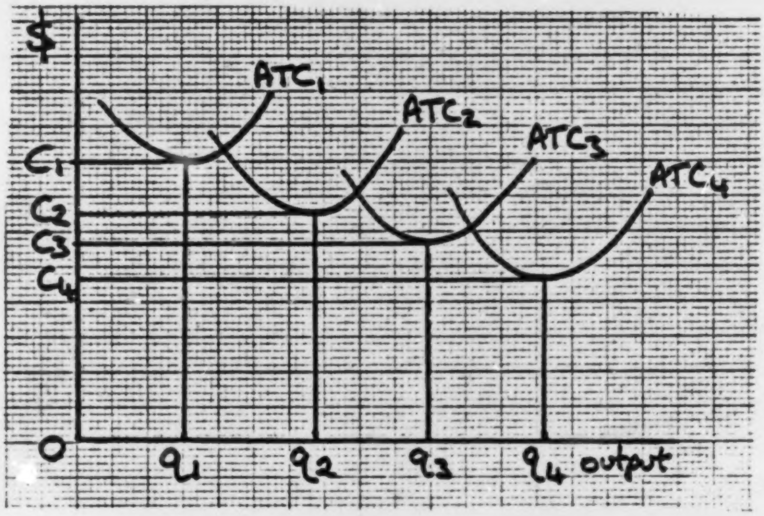
6.3.10 **Despite economic inefficiency caused by monopoly, it may be in society's interest to have only one producer of a good or service if economies of scale exist.**

Example. Many towns have only one supplier of electricity and one supplier of gas (local utilities) because of economies of scale.

6.3.11 **A firm experiences economies of scale when, as output expands, average costs decline.**

Example. Economies of scale are illustrated in Diagram 6.3.11(1).

Diagram 6.3.11(1): Economies of Scale



Curves ATC, ATC_2, ATC_3 and ATC_4 denote the unit costs incurred at increasing scales of operation, i.e. as a firm's plant size increases. At larger sizes minimum average total costs are lower, i.e. $C_1 > C_2 > C_3 > C_4$.

6.3.12 **The most common sources of economies of scale are specialization of labor and the lower per unit costs associated with the increased size of capital equipment.**

Example. Two hundred years ago Adam Smith pointed out the significance of division of labor, or specialization, in firms which increase their level of output. In such firms *employees can concentrate on applying specialist skills to particular jobs in comparison to firms with relatively lower levels of output where employees have to undertake a variety of jobs.*

An oil tanker provides an example of economies of scale due to the effect on average cost of increasing the dimensions of capital equipment. The total cost of a large tanker is obviously greater than the total cost of a small tanker, and total costs will rise with tanker size in proportion to the increased surface dimensions, i.e. measured in square metres. But the unit costs of tankers are also determined by their capacity, i.e. the volume of oil they are capable of holding, measured in cubic metres. Since capacity will increase by a greater amount than the cost of increasing surface dimensions as tanker size increases, average costs will fall.

In some industries, particularly the chemicals industry, the relationship between the increasing size of capital equipment and lower average cost is so predictable that engineers have developed a rule of thumb known as the '0.6 rule' to assist them in estimating the effect of installing larger capital in the form of plant and equipment. This rule states that whenever the capacity of a piece of capital equipment is multiplied by a certain amount, x, the capital cost rises by $x^{0.6}$. *More generally, scale economies due to this type of increased capital dimension can be expressed by the exponent b in the formula*

$$C = ax^b$$

where C = *capital cost,* x = *output level,* a = *constant term and* b = *coefficient of scale. If the value of b were 1, for a given increase in output the average capital cost would remain constant. If the value of b were greater than 1, average capital cost would increase as output expands. If the value of b were less than 1, average capital cost would fall as output expands.*

In a study undertaken in the US, two economists, Haldi and Whitcomb, analyzed 678 types of capital equipment and found that in 90% of the cases the value of the scale coefficient was less than 1, with a very high proportion having a value between 0.5 and 0.7.

6.3.13 If the production of a good is characterized by economies of scale, one large firm would be able to produce a given level of output at a lower per unit cost than many small firms, i.e. fewer resources would be required for a given level of output.

Example. Economies of scale were illustrated in Diagram 6.3.11(1). Suppose there were two ways of producing output Oq_4. *First, four firms, each operating on ATC, would produce Oq, resulting in total output of* Oq_4. *Second, one large firm, operating on* ATC_4, *could produce* Oq_4. *The latter* *arrangement would use fewer resources to produce* Oq_4 *since the per unit cost to the large firm would be* OC_4 *whereas each small firm could produce its share of total output* Oq_4 *at the higher per unit cost of* OC_1.

6.3.14 If economies of scale exist in an industry, there will be a tendency for monopoly to arise since only a firm which accounts for a very high proportion of total market output will find it profitable to exist, typically the first firm to move down the long run average cost curve.

Example. Industries such as steel, railroads, gas and telephones, are often called "natural" monopolies because minimum average costs are obtained only when a very high proportion of market output is supplied by one firm. This makes it natural for one firm to dominate the industry, and unprofitable for a large number of relatively smaller firms - each producing a much smaller output level at higher average cost - to exist. Thus it would be inconceivable, as well as a waste of resources, to have thousands of tiny telephone companies each supplying all the necessary communications equipment and resulting in thousands of telephone cables and poles crammed together near highways.

6.4 Imperfect Competition

6.4.1 An imperfectly competitive industry consists of a number of firms each facing a downward sloping demand curve for its good or service. Under imperfect competition fewer firms exist than in perfect competition. Conversely, in comparison co monopoly, an imperfectly competitive industry contains more than one supplier.

Example. Macdonalds and Jack-in-the-Box each supply hamburgers under imperfectly competitive conditions. Each firm faces a downward sloping demand curve for its hamburgers, meaning that each firm may affect the selling price of its hamburgers by its own actions. Macdonalds, for example, may raise the price of its hamburgers and as a result sell fewer hamburgers - but not lose all its sales as would occur under perfect competition.

6.4.2 Firms have a degree of control over price because of several factors. There may be real or imagined differences between their goods or services and the goods or services of competitors. Such imagined differences may be due to advertising. There may also be elements of local monopoly which, because of consumers' valuation of time and convenience, allow a firm some control over its price.

Example. In a typical US city there are dozens of hamburger restaurants. Each restaurant usually incurs some expenditure on advertizing its attractive qualities and the special appeal of the hamburgers it sells, e.g. Macdonalds and Jack-in-the-Box. The purpose of such advertizing is partly to bring to the public's attention the existence of the restaurant and its hamburgers, and partly to persuade consumers about the special features or qualities offered by the restaurant and its hamburgers. Such advertizing builds up a degree of brand loyalty which means that when a firm raises its price it does not lose all its sales to competitors.

In one area of a city there may only be one hamburger restaurant. Its control over price may derive from the fact that all its consumers, in response to a rise in the restaurant's prices, would not go to similar restaurants elsewhere in the city because they do not wish to incur the inconvenience, the travelling time and cost, or even the cost of finding out what other restaurants exist and the nature and price of the service they offer.

6.4.3 Firms may enter or leave an imperfectly competitive industry in response to the level of profit being earned. Since the actions of one firm will affect the demand curve facing other firms in an industry composed of imperfectly competitive firms, expected profit will affect the flow of resources.

Example. Any US citizen who wishes to open a hamburger stall can do so provided he can command the resources required to do so. There are no barriers to entry, and his decision to *enter the industry will depend on the number of existing hamburger firms and the share of the market, and consequent profit he could expect to obtain.*

6.4.4 The greater the real or imagined differences between each firm's good or service, or the greater the degree of local monopoly a firm has, the more inelastic its demand curve will be.

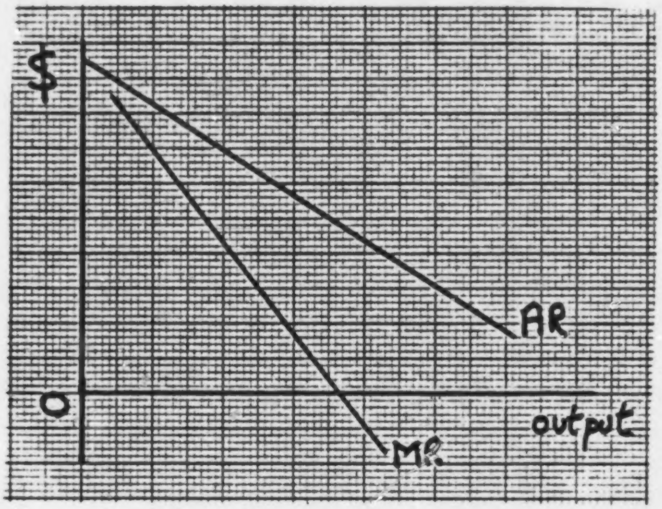
Example. Although the hamburgers sold in different restaurants are made to appear different in the eyes of consumers, they are nevertheless reasonably close substitutes. If one restaurant decided to increase the price of its hamburgers, they would lose some customers to other restaurants. However, some people would still remain loyal and go to the more expensive hamburger restaurant because of real or imagined differences in the hamburgers supplied. The degree of demand elasticity would depend upon consumers' judgment about the substitutability of the hamburgers. If most consumers thought that the hamburgers sold in different restaurants were virtually identical, each restaurant would face a highly elastic demand curve, indicating that a given percentage change in price would result in a much greater percentage change in quantity demanded. In contrast, however, if one restaurant managed to convince consumers that its hamburgers really were unique and a large number of consumers remained loyal to the restaurant despite a price increase then the restaurant would face a more inelastic demand curve.

Also, as shown in 6.4.2, the sole restaurant in a particular area might be able to charge higher prices than restaurants in other areas. The extent to which it would lose sales by doing so - and hence the elasticity of demand for its hamburgers - would depend upon the importance its customers attached to travelling time and cost, convenience, and the cost of obtaining information about alternative restaurants.

6.4.5 Since each firm in imperfect competition faces a downward-sloping demand curve, average revenue and marginal revenue will diverge.

Example. For the same reasons as outlined in 6.3.4, marginal revenue falls as output expands and at a faster rate than average revenue. Typical average revenue and marginal revenue curves facing an imperfectly competitive firm, for whose good the demand is relatively elastic, are shown in Diagram 6.4.5(1).

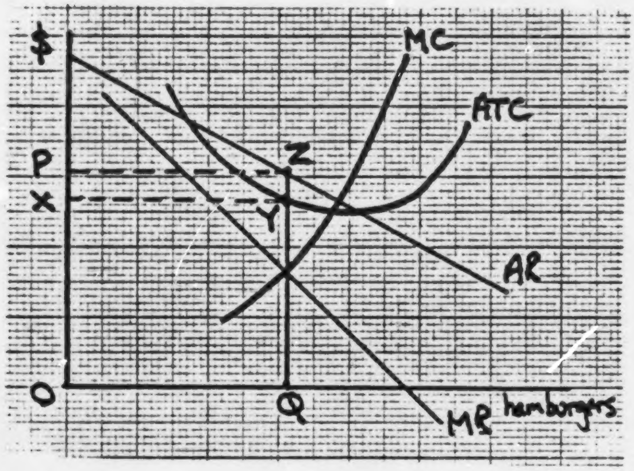
Diagram 6.4.5(1): Average Revenue and Marginal Revenue for a Firm in Imperfect Competition



6.4.6 The decision rule for maximizing profit for a competitive firm and for a monopolist applies to the firm in imperfect competition. Output should be expanded or contracted to the point at which marginal cost equals marginal revenue.

Example. Suppose a typical hamburger restaurant in a US city is faced with the cost and revenue curves as illustrated in Diagram 6.4.6(1).

Diagram 6.4.6(1): Short Run Profit Maximization for a Firm in Imperfect Competition

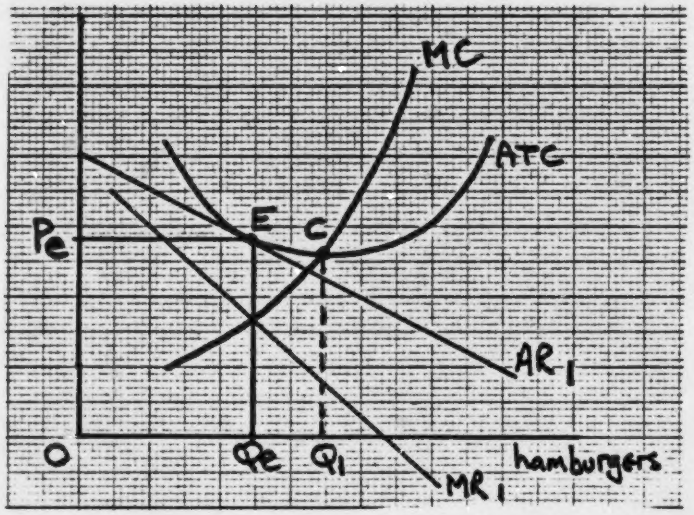


The restaurant would sell OQ hamburgers at a price of OP in order to maximize profit. Because price is greater than average total costs, higher than normal profit is being earned, denoted by the shaded area PXYZ.

6.4.7 The existence of above normal or below normal profit will provide an incentive for new firms to move into or out of the industry. As new firms move in or out, assuming factor prices remain constant, the demand curve of existing firms will shift to the left or right until in long run equilibrium the firm's demand curve is tangential to its average cost curve and normal profit is earned. If factor prices do change as new firms enter or leave the industry both the firm's demand curve and cost curves will shift until again long run equilibrium is established when normal profit is earned. The firm's long run equilibrium price and output would be different in a situation where factor prices remained constant compared to a situation where factor prices charged.

Example. In response to the profit being made by existing hamburger restaurants, suppose new firms decide to open up restaurants in different parts of the city. As shown in Diagram 6.4.7(1) in the long run the entry of new firms will continue until each firm faces a demand curve in position AR_1.

Diagram 6.4.7(1): Imperfectly Competitive Firms in Long Run Equilibrium



With a demand curve denoted by AR_1*, the profit maximizing output is* OQ_e *and the price is* OP_e*, assuming factor prices remain constant as new firms enter. Graphically, the average revenue curve is a tangent to the average total cost curve at E, and the price per hamburger* (OP_e) *is just equal to its average total cost of production* (Q_eE)*. Thus normal profit is earned, and there is no further tendency for any more hamburger restaurants to be opened up.*

6.4.8 In long run equilibrium, a firm in imperfect competition produces a level of output whose price is greater than marginal cost. Thus economic inefficiency results because the ratios of marginal utility to marginal cost in different industries will not be equal.

> *Example. For the same reasons as outlined in 6.3.9, when* $P \neq MC$*, marginal cost cannot be substituted for price in* $\frac{MU}{P}$ *ratios. Hence ratios of* $\frac{MU}{MC}$ *would be greater in imperfectly competitive industries than in perfectly competitive industries. The achievement of economic efficiency would require that price be set equal to marginal cost by imperfectly competitive firms. But since this would result in a non-profit maximizing output, given rational firm behavior, it will not occur.*

6.4.9 In long run equilibrium, a firm in imperfect competition produces an output level above the minimum point on the average total cost curve.

> *Example. It would be possible for each of the hamburger restaurants to produce an output at a lower unit cost than occurs in long run equilibrium, e.g. in Diagram 6.4.7(1) at point C on the ATC curve, compared to point E. But this would result in losses being incurred by the restaurants because, at the associated output level of* OQ_1*, average total cost exceeds average revenue. Hence there is no incentive for individual restaurants to expand beyond the output level* OQ_e*.*

6.5 Regulation and Economic Efficiency

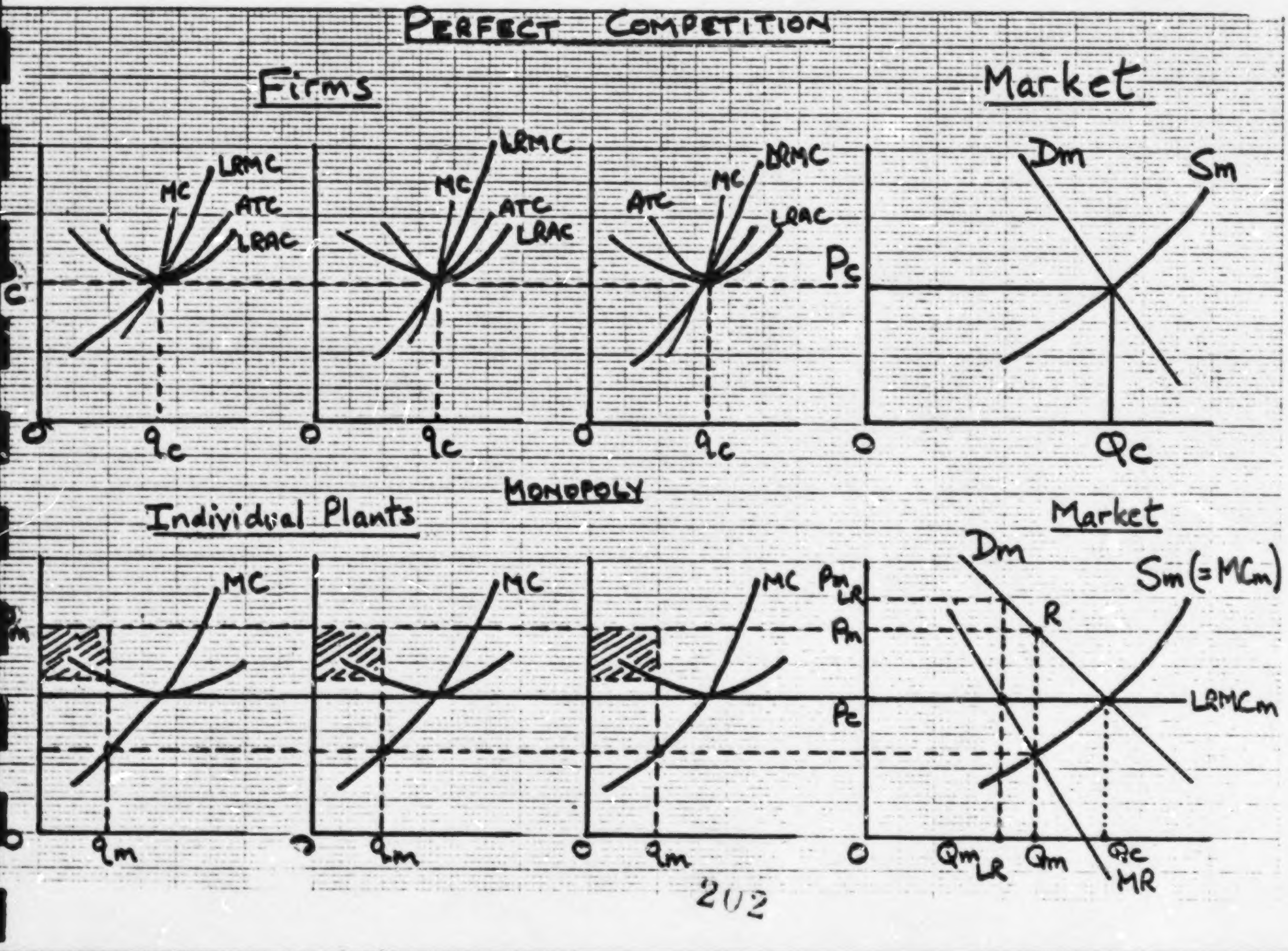
6.5.1 When an unregulated profit maximizing monopolist is the supplier in a market, economic efficiency will not prevail in the economy since the marginal equivalency conditions will not be met (6.3.9). To achieve economic efficiency, collective action on the part of society, i.e. regulation, is required to equate price with marginal cost of the good in question.

> *Example. Major monopolies in the U.S. are subject to some form of government regulation. In many public utilities, for example, price changes require governmental approval and in granting or denying price changes the marginal conditions typically are considered.*

6.5.2 In certain circumstances economic efficiency can be achieved by replacing a monopolist with competitive firms.

> *Example. Suppose a certain drug is produced by three small firms operating under competitive conditions. As shown in Diagram 6.5.2(1), each firm is in long run equilibrium producing Oq_c units at a price of OP_c. The price of the drug is determined by the intersection of the market demand curve Dm and the market supply curve Sm which is the summation of the firms' marginal cost curves. Market equilibrium is achieved at price OP_c and output OQ_c.*

Diagram 6.5.2(1): Perfect Competition vs. Monopoly


PERFECT COMPETITION
Firms
Market
MC
LRMC
ATC
LRAC
C
0
qc
Dm
Sm
Pc
Qc
MONOPOLY
Individual Plants
Market
MC
m
qm
Sm(=MCm)
Pm LR
Pm
Pc
R
LRMCm
QmLR
Qm
Qc
MR

Now suppose one firm takes over all three drug manufacturers, obtains a patent to manufacture the drug and thus becomes a monopolist. As shown in Diagram 6.5.2(1), the monopolist's marginal revenue curve diverges from his average revenue curve, i.e. the market demand curve. Given profit maximizing behavior, the monopolist would produce that level of output at which marginal revenue equals marginal cost, i.e. the industry supply curve. Thus under monopoly conditions, OQ_m is produced at price OP_m, i.e. price is higher under monopoly than under perfect competition ($OP_m > OP_c$) and output is lower ($OQ_m < OQ_c$).

Under monopoly, each individual plant produces that level of output at which the monopolist's marginal revenue equals marginal cost, i.e. Oq_m. Given the monopoly price of the drug of OP_m, each plant thus makes an above normal profit, shown by the shaded areas in Diagram 6.5.2(1), and the total amount of above normal profit earned by the monopolist is the area P_mRST.

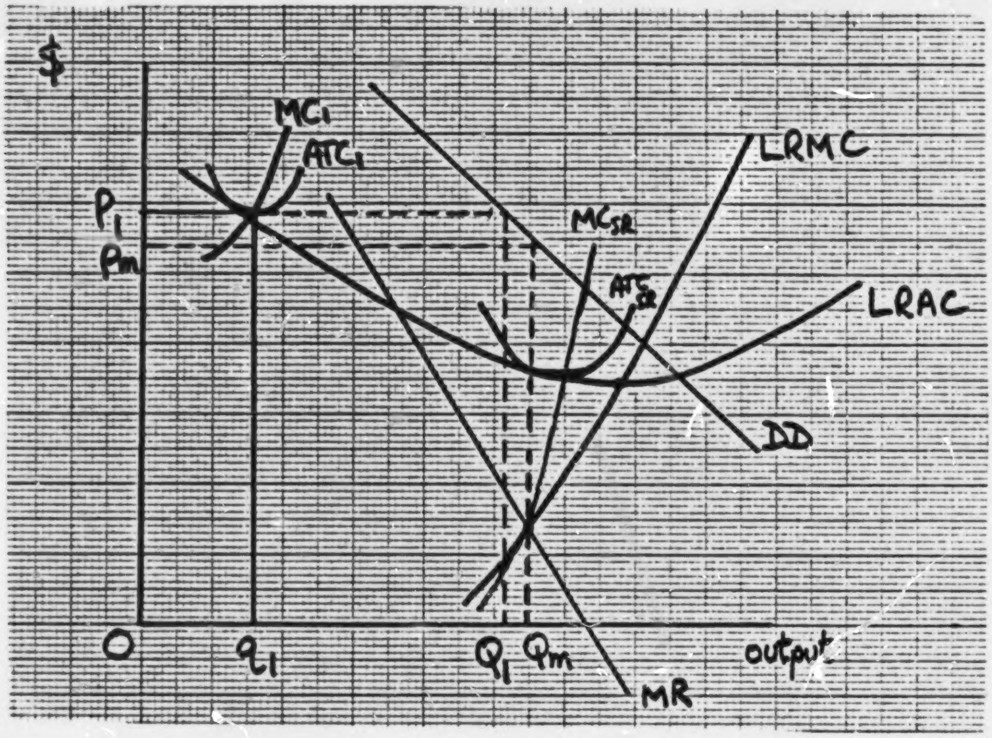
An output level of OQ_m and price OP_m, however, represent only a short run equilibrium position for the monopolist. Assuming unchanged factor prices, the monopolist's long run marginal cost curve, $LRMC_m$, will be a horizontal line tangential to the minimum points of each plant's LAC, i.e. additional output requires additional plants. Thus in long run equilibrium the monopolist's profit maximizing output will be OQm_{LR} and the price OPm_{LR}. In comparison to his short run equilibrium position, in the long run price will be higher ($OPm_{LR} > OPm$) and output will be lower ($OQm_{LR} < OQm$) as the monopolist will close down one or more plants in adjusting to the appropriate long run scale.

The government could achieve economic efficiency by splitting the monopolist into separate small firms because, as shown in Diagram 6.5.2(1), under competitive conditions price would be lower and output greater than under monopoly. Given perfect competition, the price of the drug would equal its long run marginal cost thereby ensuring that the marginal equivalency conditions would be met. As a result economic efficiency would be achieved.

6.5.3 If a monopolist's output is subject to economies of scale economic efficiency will not be achieved by splitting up the monopolist into small, separate, firms, because for each new firm price will exceed long run marginal cost.

Example. Suppose economies of scale exist in processing a certain metal and that these economies of scale are such that one firm supplies the whole market. The monopolist is faced by a demand curve DD, as shown in Diagram 6.5.3(1).

Diagram 6.5.3(1): Price and Output under Perfect Competition and Monopoly with Economies of Scale



Further suppose that the monopolist is in long run equilibrium producing an output of OQm. The conditions necessary for long run equilibrium are shown in Diagram 6.5.3(1), i.e. MR = LRMC = MC_{SR} *and* ATC_{SR} *= LRAC. The selling price would be* P_M*. Economic efficiency would not prevail in the economy because in the metal processing industry price would exceed marginal cost.*

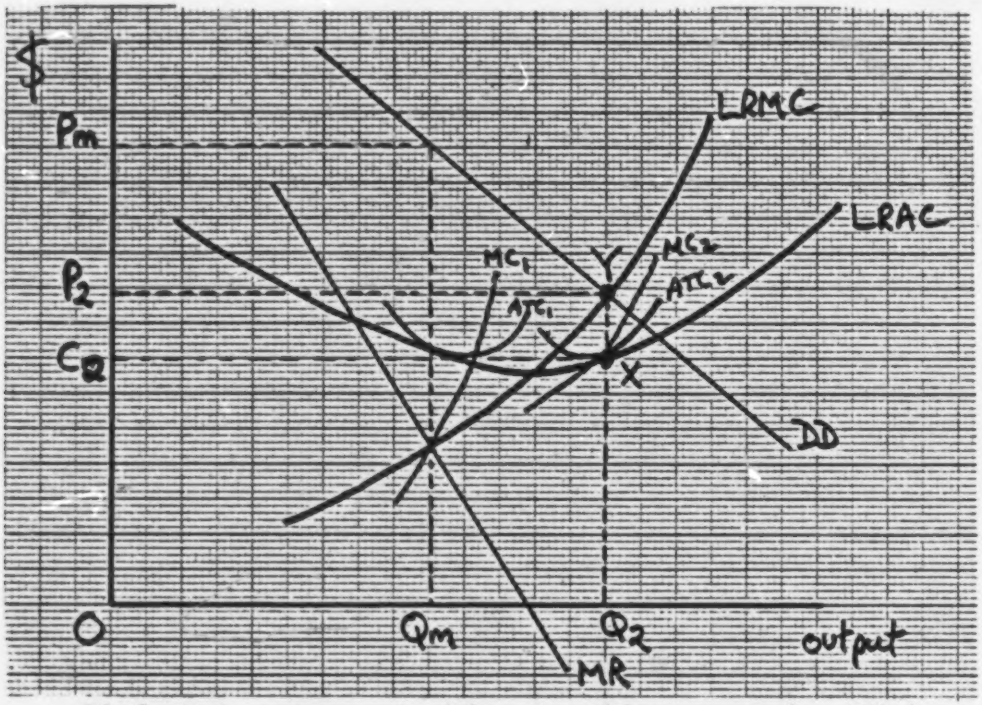
Suppose the monopoly were broken up and replaced by a number of identical small firms each producing oq_1*, for a total output of* OQ_1*. Equilibrium price would be* OP_1 *and each firm would be in short run equilibrium (i.e.* $p = MC_1$*) producing at the minimum point of its ATC. However, no firm would be in long run equilibrium because P > LRMC. Thus because of economies of scale in the industry the price of its metal would be lower under monopoly than if produced by a large number of smaller firms (OPm <* OP_1*) and output would be greater (OQm >* OQ_1*), i.e. consumers would enjoy a greater output at a lower price under monopoly than under short run competitive conditions. In industries where economies of scale exist, regulation which replaces a monopoly by a large number of small firms will make society worse off.*

The Australian government's insistence that the production of automobiles takes place in small units results in highly priced Australian automobiles compared to the automobiles of other nations which take advantage of economies of scale.

6.5.4 **When production is characterized by economies of scale, regulation to equate price with marginal cost is necessary to achieve economic efficiency.**

Example. Suppose a monopolist steel producer were in long run equilibrium, producing output OQm at a price of OPm as shown in Diagram 6.5.4(1).

Diagram 6.5.4(1): Regulating Price Equal to Marginal Cost



If the U.S. government wishes to achieve economic efficiency and reap the benefits of economies of scale, price would be set at OP_2*, i.e. where price equals long run marginal cost (point Y). Thus the price of steel would be lower than under prevailing monopoly conditions (*$OP_2 < OPm$*) and output would be greater (*$OQ_2 > OQm$*). Economic efficiency would be achieved since price equals long run marginal cost, and hence the marginal equivalency conditions are met.*

Note, without regulation economic forces will not lead to economic efficiency. However, once the price has been regulated at OP_2 *and the monopolist becomes a price taker, profit maximizing (loss minimizing) behavior will cause the monopolist to adjust plant size in the long run to produce* OQ_2 *with the least amount of resources, i.e. be on LRAC.*

6.5.5 In competitive markets in long run equilibrium, $P = MC_{SR} = LRMC = \text{Min ATC} = \text{MinLRAC}$. Under regulation, when price is equated with LRMC and the monopolist adjusts his plant size to equate price with MC_{SR} there is no guarantee that price will also equal MinATC and MinLRAC.

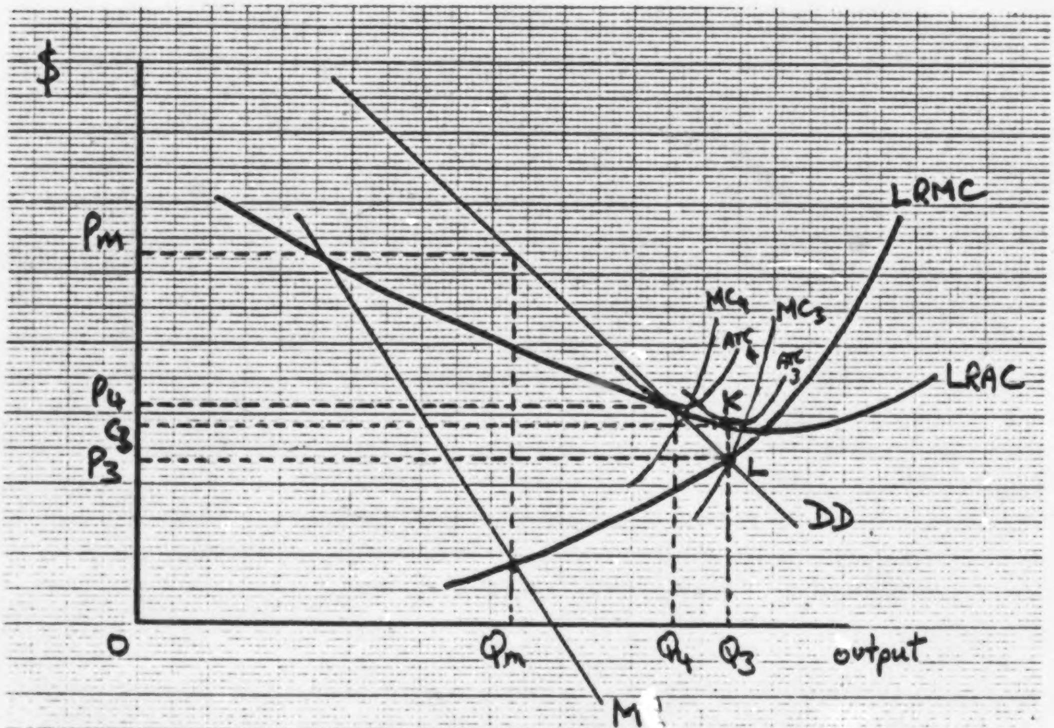
6.5.5.1 Under regulation, if price exceeds ATC and LRAC, above normal profit will be earned. A profit tax will remove the above normal profit without establishing forces which would cause price or output to change. Without such a tax at least one factor of production will earn above normal returns, but the existence of economies of scale will prevent factors of production being attracted into the industry seeking these returns.

> *Example. If the price of metal were regulated at* OP_2*, as shown in Diagram 6.5 4(1), the monopolist would still earn above normal profit. Price per unit is* OP_2 *(*$= Q_2Y$*) whereas the unit cost is* OC_2 *(*$= Q_2X$*). Since* $Q_2Y > Q_2X$ *the monopolist earns above normal profit of YX per unit. The existence of economies of scale, however, will prevent factors entering the metal processing industry and so at least one factor employed by the monopolist would continue to earn above normal returns. The government can remove the above normal profit by means of a tax, thereby removing the above normal return earned by the factor(s).*

6.5.5.2 Under regulation, if price is less than ATC and LRAC, insufficient returns will be earned to keep resources in the industry. A subsidy will be necessary to prevent resources from leaving the industry, or, alternatively, the regulating agency may allow the firm to set price equal to average cost, recognizing that an economic efficiency loss will occur.

> *Example. Suppose the price of a monopolistically produced good were regulated at* OP_3 *(= LRMC) as shown in Diagram 6.5.5.2(1).*

Diagram 6.5.5.2(1): Price Regulation resulting in Below Normal Profit



The profit maximizing (loss minimizing) monopolist will produce OQ_3 *but since at the output and price average costs (ATC and LRAC) exceed average revenue, the monopolist will earn below normal profit of KL on each unit produced. At least one factor employed by the monopolist will earn less than normal returns and hence there will be a movement of factors out of the industry in the long run. Indeed, if* $OP_3 >$ *average variable costs, the mmopolist would cease production in the short run. To prevent resources moving out of the industry the monopolist would require a subsidy of KL per unit, just sufficient to ensure normal profit. Alternatively, the regulating agency may allow the price to be set at the higher level of* OP_4*, where price is equal to ATC. By doing so, a lower output of* OQ_4 *is produced. In adopting this policy, the regulating agency would realize that while normal returns are earned, economic efficiency will not occur, since P > LRMC.*

6.5.6 When monopoly exists in an economy, economic efficiency will not prevail. Since, under monopoly, price exceeds marginal cost, the ratio of $\frac{MU}{MC}$ for the monopolist's good is greater than the ratio of $\frac{MU}{MC}$ for competitively produced goods. By regulating the monopolist's price equal to marginal cost, however, more of the monopolist's good and fewer competitive goods will be produced. Society's utility will be increased by the reallocation of resources from competitive industries to the monopolistic industry, and economic efficiency will be achieved because the marginal equivalency conditions will be satisfied.

Example. Suppose for good A, produced under monopoly conditions, $\frac{MU_A}{MC_A} = \frac{4}{2}$*, and for good B, produced under competitive conditions,* $\frac{MU_B}{MC_B} = \frac{3}{2}$ *(6.3.9). By setting the monopolist's price = marginal cost, the output of the monopolist's good expands (Diagrams 6.4.5(1) and 6.5.5.2(1)).*

Such expansion of the monopolist's output is possible only by transferring resources from competitive industries. Suppose that \$2 worth of resources were transferred from the production of good B to good A. Since the MC of both good A and good B is \$2, one more unit of A, and one unit less of B, would be produced. Consumers would lose 3 units of utility from the decreased output of good B, but would gain 4 units of utility from the increased output of good A. Hence society as a whole would enjoy a net increase in utility as a result of the re-allocation of resources. When P = MC in the production of good A, there will be no further incentive for resources to be re-allocated, and economic efficiency will be achieved since $\frac{MU_A}{MC_A} = \frac{MU_B}{MC_B}$.

5.5.7 All regulation requires resources. What a society must decide in order to make best use of its resources is whether the formation and running of regulating agencies yields a net benefit to society.

Example. Empirical evidence suggests that in certain major industries regulation is worthwhile but that in many imperfectly competitive industries the costs of regulation would exceed the benefits. Professional economists are sharply divided on the issue of regulation. Many argue that the costs of regulation are both prohibitive and remove economic incentives. Others argue for more regulation on both efficiency and equity grounds.

MICRO UNIT 7

PUBLIC GOODS AND EXTERNALITIES

7.1 Public Goods vs. Private Goods
7.2 Public Goods, Collective Action and Economic Efficiency
7.3 Externalities: Positive and Negative
7.4 Externalities, Collective Action and Economic Efficiency

7.1 Public Goods vs. Private Goods

7.1.1 A distinction can be made between private goods and public goods.

7.1.1.1 A private good is one which can be supplied in such a way that only those individuals who buy the good benefit from it, and whose consumption by one individual reduces the amount that can be consumed by other individuals.

> *Example. Most types of foods are private goods. If a student buys a hamburger, only that student derives benefit from its consumption. Also, in buying the hamburger, he reduces the quantity which other consumers can buy.*

7.1.1.2 A public good is one whose benefits can be enjoyed by everyone once any amount of it is made available, and whose consumption by one individual does not reduce the amount that can be consumed by other individuals.

> *Example. Defence programs in most countries are public goods. Once the U.S. Army is established, all U.S. citizens may enjoy the benefits of security which it provides. Also, the fact that citizens in Texas enjoy the benefit of security provided by the Army in no way detracts from the benefits enjoyed by the citizens of California, or any other state.*

7.1.2 The main difference between private and public goods lies in the divisibility of costs and benefits. In the case of private goods, costs and benefits are completely divisible among consumers. In the case of public goods, the costs and benefits are completely indivisible.

> *Example. When hamburgers are supplied in an economy, the benefits are divisible among those consumers who buy hamburgers in relation to the quantity they buy. When any individual buys a hamburger, no external benefit or cost is imposed on any other individual. When, however, army services are provided, it is impossible to divide up the benefits. The more security there is available for one individual, the more security there is available for all individuals.*

7.1.3 Resource allocation for private goods can be achieved through the market and the mechanism of price.

> *Example. The quantity and price of foodstuffs can be determined by the normal market process. Those individuals who wish to buy hamburgers at various prices will have their preferences reflected in a demand curve, and only those who pay for hamburgers will be able to enjoy the benefit of the quantity supplied. In turn, producers supply hamburgers only to those individuals who are prepared to pay.*

7.1.4 Public goods cannot be provided by markets because there is no way of preventing people who are not prepared to pay for the goods from receiving the benefits they provide. Since benefits and costs of public goods are indivisible, there is no incentive for any individual to pay for their provision.

Example. Imagine what would happen if defence services were to be provided by the market. Even if some individuals (e.g. residents in Beverley Hills) were motivated to buy protection, they would have to provide defence services (army, navy and airforce) on a scale sufficient for the purpose, i.e. to deter potential foreign aggressors. But as soon as these security services came into existence, their benefits could not be limited only to those who had paid for them. Everyone else would receive the same degree of protection, i.e. there is no way of excluding non-payers from receiving the benefits. So there is no incentive for anyone to pay for defence, knowing in advance that everyone else would receive the same benefits on the "free-rider" principle.

7.1.5 Although public goods would not be provided if left to individual market transactions, they would be provided if individuals grouped together to act collectively in deciding how much of the good they wished, and how the cost of providing it would be shared amongst them.

Example. The economic case for governments, rather than markets, deciding about the optimum level of defence services rests on the argument that defence would not be provided at all if left to the market. Hence citizens act collectively through the government to decide on how many resources to allocate to defence, which can then be paid for by general receipts from taxation.

7.1.6 While the characteristics of private goods and public goods outlined above are useful for definitional purposes, few goods in the real world are completely private or completely public in the "pure" sense.

Example. Most goods and services, whether they are provided through the market or by collective action, are mixtures of private and public elements. This is illustrated in Diagram 7.1.6(1).

Diagram 7.1.6(1): Private Goods and Public Goods

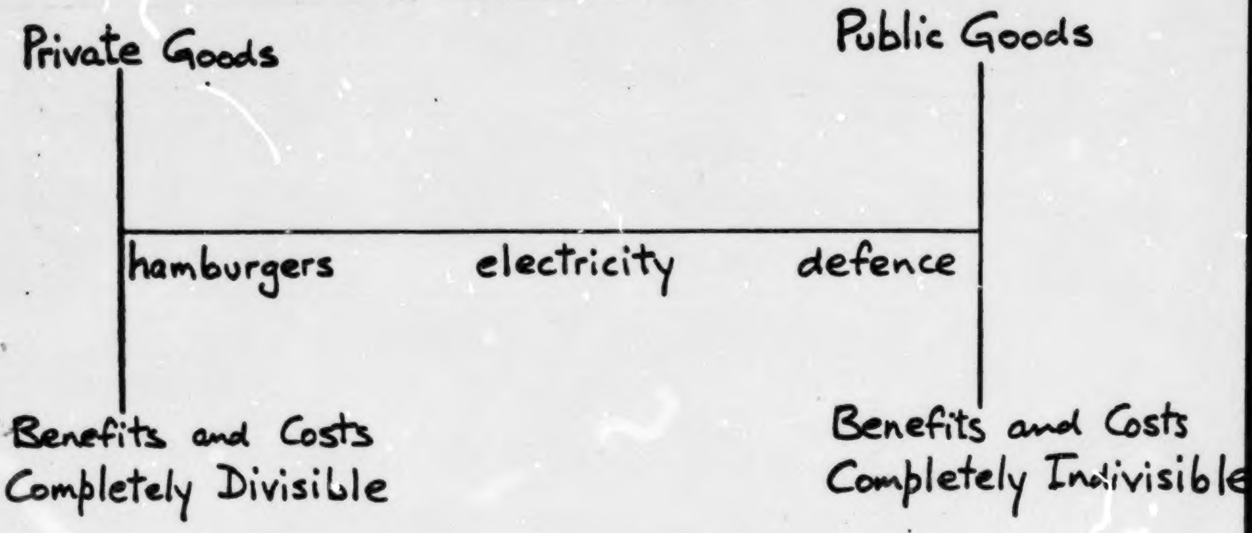

Private Goods
Public Goods
hamburgers
electricity
defence
Benefits and Costs Completely Divisible
Benefits and Costs Completely Indivisibl

Diagram 7.1.6(1) illustrates the characteristics of goods by using a scale. At one end are the pure private goods such as hamburgers whose costs and benefits are completely divisible. At the other end are the pure public goods such as defence whose costs and benefits are completely indivisible. In the middle are goods such as electricity which contain a mixture of private and external costs/benefits.

Medical care, for example, is neither a pure private good nor a pure public good. Instead it contains some elements of a private good and some elements of a public good. Many of the benefits of medical care are divisible and specific to the individual who receives it. If an individual contracts smallpox, he may pay for the necessary medical resources required to treat the disease and directly benefit from the treatment he receives. However, other individuals in society may also benefit from the medical care he receives because of the reduced risk of such a contagious disease spreading.

Freeways provide another example of goods which are partly private and partly public in nature, although in most economies the case for collective provision rests on the extent of "public" features which they have. It might be possible to arrange for drivers to use freeways only if they pay for the journeys which they make. In some countries, such as France, automobile drivers cannot use certain freeways unless they pay a toll which is charged as each motorist enters a particular stretch of the freeway. But charging for freeways in this manner is limited to those stretches whose physical characteristics make payment possible and not excessively costly to collect. If, for example, a freeway has a well-defined entry point, and there is no possibility of using just one section of it by entering or leaving on unsupervised slip roads, then it is possible to exclude those who do not pay from enjoying the benefits.

Further, it is not necessarily the case that the greater the provision of freeways, the more the benefits are enjoyed by everyone. When freeways are congested, their use by some drivers reduces the amount available for other drivers, as is often seen in freeways close to major U.S. cities at rush hours.

But although freeways have many of the features of private goods, most countries tend to have them provided collectively and paid for out of taxes paid by firms and individuals.

7.2. Public Goods, Collective Action and Economic Efficiency

7.2.1 In providing a range of goods and services, governments face resource constraints.

Example. The Federal Government spends roughly 5 times as much on health programs as it does on space and science programs. If it were assumed that these were the only two areas of government spending, a decision to increase the number of Ph.D. nuclear physicists on the space program has an opportunity cost in terms of the number of M.D.s who could be employed on cancer research. Conversely, a federal decision to increase the number of kidney machines has an opportunity cost in terms of the number of advanced radar devices foregone.

7.2.2 The government, like individuals and firms, can apply the same efficiency criteria to their spending on goods and services, i.e. by equating costs and benefits at the margin. The optimum provision of any public good or service occurs when the marginal social cost of production equals the marginal social benefit obtained.

Example. Some of the main items of Federal expenditure in 1974 are listed in Table 7.2.2(1).

Table 7.2.2(1): Federal Spending, 1974 - Some Main Items

	$ billions
National Defence	78.6
Space and Science	4.2
Health	22.1
Education and Manpower	11.6
Commerce and Transport	13.1

In assessing whether it is providing an economically efficient level of each type of good and service, the Federal Government would have to compare the marginal social benefits of each type of program with its marginal social costs. In the case of defence expenditure, the benefits are entirely indivisible amongst U.S. citizens. But in the case of health expenditure there may be a difference between the purely private benefits accruing to those individuals who receive certain types of medical attention, and the wider social benefits which accrue to people who may not have been direct recipients of medical attention. For example, the Federal Government may provide a medical program to immunize everyone under a certain age against specific diseases. Apart from the benefits to those who are immunized, many other sections of the population may benefit because of the reduced risks of contracting contagious diseases, reduced number of working days lost due to ill health leading to higher output, etc. Hence it is the marginal social benefit which is important in gauging the efficiency of public sector spending.

Similarly, it is critical to measure the marginal social cost of Federal spending programs. When a decision is made to expand the number of U.S. college students, payments have to be made for the necessary resources, e.g. buildings, equipment, professors, sports and residential facilities, etc. But while these resources have costs which are paid for, there are also wider social costs. By expanding the student population by, say, 10,000, the economy is sacrificing the output they would otherwise have produced had they been members of the active labour force instead of students. Hence the marginal social cost of this decision includes a valuation of the students' lost output.

Only when $\frac{MSBdefence}{MSCdefence} = \frac{MSBhealth}{MSChealth} = \frac{MSBz}{MSCz}$ *where MSB = marginal social benefit and MSC = marginal social cost, will the optimum level of provision be obtained.*

7.2.3 It may be difficult to assess the efficiency of public goods' provision due to the absence of consumers' valuation of benefits.

Example. Any attempt to discover the correct, i.e. economically efficient, number of freeways must depend on some assessment of how far U.S. citizens value the benefits of freeways. Unlike hamburgers and automobiles, however, we cannot directly observe the value placed on freeways because the major benefits they generate, i.e. reduced travelling time, lower accident rates, are not bought and sold in markets and so have no conventional price.

If, however, the Federal Government attempted to derive money values for time (which is a scarce resource and has an opportunity cost) and fatal or serious injury (which has a direct economic impact on society's ability to produce through the reduction - temporarily or permanently - in the labor force) it would have a value of marginal social benefit to compare to the appropriate marginal social cost.

7.2.4 The issue of who pays for the benefits generated by public goods involves considerations of equity. Governments typically finance public goods provision according to ability to pay rather than according to who benefits.

Example. It might be argued that every U.S. citizen benefits equally from national security services and so each individual should pay an equal share of the cost (notice that this argument overrides differences in individuals' feeling towards defence; although certain individuals, e.g. extreme pacifists, may object deeply to the provision of defence at all and would not buy any defence services even if they could be allocated to markets, it is still assumed they benefit from whatever provision is made).

If individuals did contribute equally in dollar terms to the provision of national security services, poorer individuals *would clearly pay a higher proportion of their incomes for defence than richer individuals. If, however, individuals were taxed an equal proportion of their incomes to pay for defence, poorer individuals would pay less in dollar terms than individuals with higher incomes. Indeed, if the higher an individual's income the higher the proportion he pays for a public good like defence, then in dollar terms richer individuals would pay considerably more than poorer individuals than under the equal proportions system.*

The difference between each method of deciding who pays is one of income distribution. Under a flat rate or equal sum schume, poorer families are worse off than they would be under an equal or higher proportion scheme. Conversely, individuals with higher incomes are better off under the flat rate system than under the other systems. The Federal Government, like other western governments, adopts a system for financing federal expenditure which deducts higher proportions from progressively higher income levels. In 1975, for example, the proportion deducted from U.S. citizens' income ranged from 0% at income levels of $2000 per annum and below, to 41% at $75,000 per annum.

7.2.5 Although it is possible to apply economic criteria to decisions about the optimum level of public goods provision, economic criteria cannot settle the issue of who should pay. In other words, economic criteria can determine the most efficient output of public goods, but it cannot determine the best form of income distribution. This involves considerations of equity rather than efficiency.

Example. Suppose the Federal Government were considering building a new freeway, and that three groups of citizens were debating who should pay. Group 1 argues that those who receive the greatest benefit from using the freeway should pay and that tolls should be charged to users. Group 2 argues that motorists in general, i.e. both users and non-users of freeways should pay for the new freeway since motorists as a group receive the greatest proportion of benefits - private and social - generated by freeways. Group 3 argues that the new freeway should be financed by receipts from general taxation.

Economic criteria, by the comparison of marginal social benefits and marginal social costs, can determine the most efficient stretch of freeway to be built. But whether only some motorists, or all motorists, or all U.S. citizens, should pay for whatever stretch of freeway is built involves a judgment of equity and cannot be decided by economic criteria.

7.3 Externalities: Positive and Negative

7.3.1 **Every economic activity involves costs and benefits.**

Example. When an individual buys a hamburger, the benefit he receives is the gain in his utility from consuming the hamburger. The opportunity cost is the best alternative foregone, e.g. a pint of beer. The resources allocated to the hamburger are not available for beer.

7.3.2 **In making an economic decision the costs which an individual or firm considers are private costs, i.e. the costs he (it) must bear in taking a course of action.**

Example. Suppose a firm considers building a power plant to supply electricity to a city, and that the firm intends to use coal as the fuel source of energy to produce electricity. In making its decision the firm will consider costs of recources such as the land required to build the power plant, the plant itself, the equipment and fuel needed to generate electricity, plus the labor needed to manage and operate the plant. Such costs are private costs, i.e. they are borne purely by the firm.

7.3.3 **In making an economic decision the benefits which an individual or firm considers are private benefits, i.e. the benefits he will receive in taking a course of action.**

Example. In deciding to buy a writing pad a student considers the benefits he will derive, e.g. the facility for taking notes during college lectures. Such benefits are private benefits, i.e. they accrue purely to the student who buys the writing pad.

7.3.4 **An individual or firm will consider an economic activity worthwhile if the marginal benefit derived from the course of action exceeds the marginal cost.**

Example. If a student considers that the marginal benefit (utility) from a hamburger exceeds the marginal cost of a hamburger in terms of the next best alternative foregone, e.g. a pint of beer, the student will buy a hamburger.

7.3.5 **For many economic activities, private costs equal social costs and private benefits equal social benefits, i.e. other individuals or firms not involved in these activities receive no benefits from those activities nor do they bear any costs of those activities.**

Example. Since each individual college student is a member of society, the total or social benefit gained from the purchase of writing pads will be the sum of the benefits *gained by each individual consumer of writing pads. Similarly, the total or social cost involved in producing writing pads will be the sum of the costs of factor inputs borne by each individual producer of writing pads. Individuals who do not buy writing pads receive no benefits from the pads produced, and only writing pad producers bear the costs of production.*

7.3.6 For some economic activities, however, individuals not involved directly in the activities receive benefits from those activities. Such benefits are known as external benefits or positive externalities, i.e. they accrue to individuals who are external to the activity.

Example. Suppose an individual decides to allocate resources to landscaping his yard because the marginal benefit of that course of action exceeds the marginal cost. Some benefit of the landscaped yard, however, may accrue to the individual's neighbors because of the improvement to their environment.

7.3.7 Similarly, for some economic activities individuals not involved directly in the activities bear some of the costs of those activities. Such costs are known as external costs or negative externalities, i.e. they are borne by individuals who are external to the activity.

Example. In the case of the power plant described in 7.3.2, the firm may impose external costs on many individuals as a result of the smoke emitted from the production process and which pollutes the air. This form of external cost is ultimately incurred by individuals who, for example, have to pay higher cleaning bills for their clothes and perhaps even their houses, and by individuals who incur medical expenses because of ill-health, e.g. lung and chest diseases contracted because of the smoke pollution in the atmosphere.

7.3.8 In deciding to carry out any economic activity, each individual, in order to maximize his utility, will ignore benefits which may accrue to other individuals in society, i.e. he will have no incentive to consider how his actions may benefit others.

Example. Consider the individual's decision to landscape his yard, described in 7.3.6 In making his decision about the type of landscaping he would like, he will consider only private benefits, i.e. the personal benefits he derives from a smart and tidy yard.

7.3.9 Similarly, each individual will ignore external costs arising from an economic activity which he undertakes, i.e. he will have no incentive to consider the costs which his actions may impose on others.

Example. In the case of the power plant described in 7.3.2 and 7.3.7, the firm in deciding whether to produce electricity will consider only the private costs incurred in building and operating the power plant despite the fact that external costs may be imposed on other individuals.

7.3.10 **For economic efficiency to prevail in the economy, the marginal equivalency conditions must hold.**

Example. If two goods, A and B, are produced in an economy, the requirement for economic efficiency is that $\frac{MU_A}{MC_A} = \frac{MU_B}{MC_B}$.

In both the short run and the long run the relevant MCs in the above equation are societal MCs, i.e. the costs to society of producing the last units of goods A and B. Similarly, the relevant MUs in the above equation are societal MUs, i.e. the benefits to society arising from the consumption of the last units of goods A and B.

7.3.11 **If the social benefits arising from an economic activity exceed the private benefits, economic efficiency will not prevail.**

Example. If external benefits arise in the allocation of resources to a good, the value of MU in the equation in 7.3.10 will understate the societal MU gained from the last dollar's worth of resources allocated to that good. Hence the ratio of $\frac{MU}{MC}$ *for that good will be lower than the ratios of* $\frac{MU}{MC}$ *for all other goods, and economic efficiency will not prevail since the marginal equivalency conditions do not hold.*

7.3.12 **If the social costs arising from an economic activity exceed the private costs, economic efficiency will not prevail.**

Example. Suppose the firm described in 7.3.7 built a power plant on the outskirts of a city and, as a result, the amount of air pollution increased. Since the firm does not take these external costs into consideration, the marginal equivalency condition does not hold because the firm's marginal cost of producing electricity will be lower than the marginal cost to society. Hence the ratio of $\frac{MU}{MC}$ *for the firm's output will be higher than the ratios of* $\frac{MU}{MC}$ *for all other goods, and economic efficiency will not prevail.*

7.4 Externalities, Collective Action and Economic Efficiency

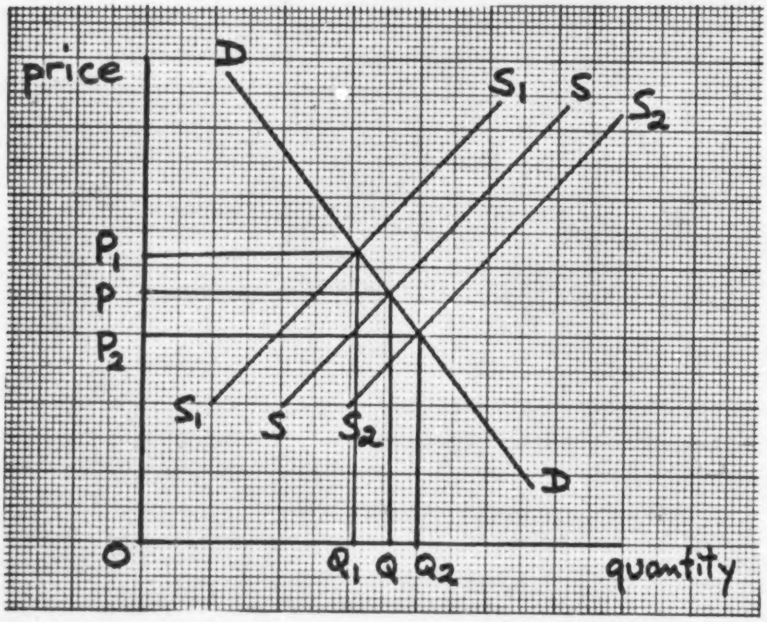
7.4.1 When externalities exist, market prices will not lead to an efficient allocation of resources because of the divergence between private costs and social and/or private benefits and social benefits. To achieve economic efficiency in the presence of externalities there is a need for collective action on the part of individuals in a society.

> *Example. In 7.3.9 it was shown that if the electricity producer did not take the costs of pollution into account in making output decisions, the marginal private cost, i.e. the extra resources cost actually incurred by the firm in producing extra output would be less than the marginal social cost. If, therefore, some form of regulation forced the firm to pay for the marginal social costs of producing electricity, there would be a different pattern of resource allocation.*

7.4.2 Collective action is required to equate the ratios of $\frac{MU}{MC}$ for all goods and services. One method of regulation is by a per unit tax imposed on firms which do not account for external costs in their decisions. Such a tax would add to each producer's marginal cost, and hence would alter each producer's profit maximizing output and price. Conversely, a subsidy paid to producers who generate external benefits by their decisions would have the effect of lowering each producer's marginal cost.

> *Example. Suppose the electricity generating industry were in competitive equilibrium, producing OQ output at price OP, as illustrated in Diagram 7.4.2(1).*

Diagram 7.4.2(1): Effect of a Tax/Subsidy when External Costs/Benefits exist



If each firm were forced to pay a per unit tax which reflected the external costs of pollution ignored in each firm's private production decision, the industry supply curve would shift back to the left, i.e. from SS to S_1S_1, *because each firm would find its marginal cost curve raised by the full amount of the tax. As a result, equilibrium output would fall and equilibrium price would rise assuming normally sloped supply and demand curves. As illustrated in Diagram 7.4.2(1), output would fall from OQ to* OQ_1, *and price would rise from OP to* OP_1. *The tax would affect the pattern of resource allocation in the industry because both producers (via higher marginal costs) and consumers (via higher prices) would now be taking the full social costs of generating electricity into account in their selling and buying decisions.*

Conversely, if the industry represented in Diagram 7.4.2(1) imposed external benefits which were not accounted for, a subsidy would have the effect of lowering each firm's marginal cost curve and thereby of shifting the industry supply curve to the right, i.e. from SS to S_2S_2. *As a result, output would increase from OQ to* OQ_2, *and price would fall from OP to* OP_2. *The changed pattern of resource allocation following the introduction of a subsidy would reflect the external benefits derived from the good.*

7.4.3 If an organization which generates external costs or benefits and the bearers of those costs or benefits were to merge into a single organization, the full costs or benefits of the organization's activities would be taken into account. When external costs or benefits are brought within the scope of a single organization, it is said that externalities are internalized.

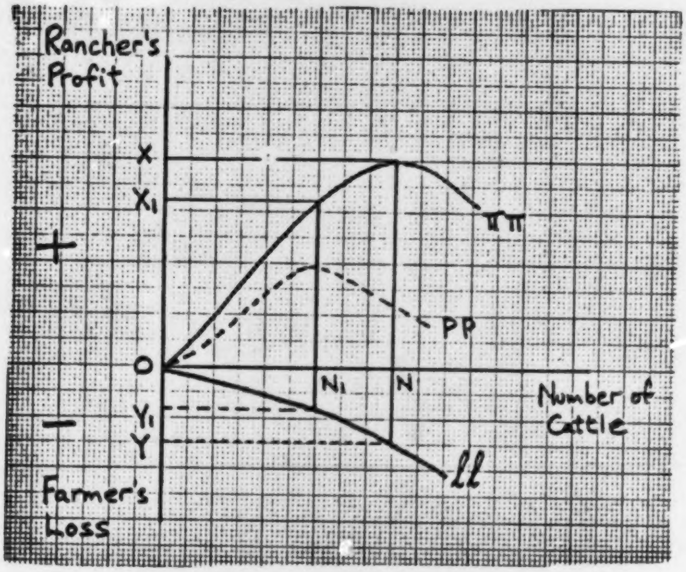
Example. Suppose a discotheque and a college bookshop were situated directly facing each other across a narrow street. The discotheque has a reputation for its exceptionally noisy atmosphere, which is the main attraction for most of its customers. In contrast, the bookshop requires a peaceful atmosphere in which students can concentrate on selecting books.

Suppose also that in response to the gradual increase in the noise level emanating from the discotheque over time the owner of the bookshop is considering installing various kinds of soundproofing equipment - the more expensive, the greater the degree of soundproofing achieved. As things stand, the cost of the service provided by the discotheque does not take into account the external cost imposed on the bookshop. If, however, the discotheque were to merge with the bookshop and form a single organization providing two different services on opposite sides of the street, the external cost associated with the noise level would be internalized. The organization would now have to take these costs into account in making *decisions about both operations. Clearly the marginal benefits gained by increasing the noise level in the discotheque (i.e. extra revenue from customers) would be offset against the marginal costs of providing various standards of soundproofing equipment.*

7.4.4 In situations where property rights are clearly defined and exchangeable, external costs and benefits may be taken into account through exchange. If one individual imposes an external cost on another individual by virtue of property rights, the person adversely affected could offer the other person a financial incentive not to exercise those rights. Further, if the person adversely affected is entitled by property rights to be free from such an external cost, the individual generating the externality could offer the other individual a financial incentive in compensation for the cost incurred.

Example. An interesting hypothetical case by Professor Ronald H. Coase gave an example of a rancher and a farmer to illustrate how, in a situation of clearly defined property rights, an external cost could be accounted for by negotiation. Suppose unfenced cattle could roam and destroy the farmer's crops. Coase argued that not only was it in the joint interest of the rancher and the farmer to negotiate a solution through exchange, but also that there would be an optimal solution whether the rancher was entitled to let his cattle roam or whether the farmer was entitled to be free of crop damage caused by any external agent.*

Diagram 7.4.4(1): Coase's Theorem: The Exchange Solution to External Costs



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* R.H. Coase, "The Problem of Social Cost", The Journal of Law and Economics, Volume 3, October 1960.

The main points of the argument can be illustrated in Diagram 7.4.4(1). Curve $\pi\pi$ measures the profit earned by the rancher for different numbers of cattle reared. Curve $\ell\ell$ denotes the loss in terms of crop damage for a given crop size incurred by the farmer. The size of this loss is related to the number of cattle reared by the rancher.

Assuming profit maximizing behavior, the rancher will rear ON cattle if he does not have to pay for any external costs caused by the cattle. Because, however, the marginal cost to the rancher of rearing ON cattle is less than the marginal society cost by the value of crop damage, ON is not an economically efficient size of herd.

But by negotiating agreed terms of exchange, both parties could become better off, and the marginal social costs of the rancher's decisions will be accounted for. From the farmer's point of view, a reduction in the number of cattle from ON to ON_1 would reduce his loss from crop damage from OY to OY_1, i.e. by YY_1. Hence the farmer would be willing to pay the rancher up to the sum of YY_1 in order to reduce his herd size by NN_1.

From the rancher's point of view, a reduction in the number of cattle from ON to ON_1 would reduce profit from OX to OX_1. Hence the rancher would be prepared to accept at least XX_1 for reducing his herd by that amount. Thus it would benefit both individuals if the rancher were to rear ON_1 cattle instead of ON cattle and the farmer were to pay him up to an equivalent to YY_1.

Indeed ON_1 would be the optimal number of cattle for the rancher to rear, i.e. optimal in the sense that it fully accounts for marginal social cost. This can be shown by drawing curve PP, which represents the farmer's and rancher's joint profit from the rancher's decisions.

Since PP measures the rancher's profit less the farmer's loss from different numbers of cattle, the curve therefore reflects the external costs imposed by the rancher. The highest joint profit which the two individuals can receive from the herd size decision is earned with ON_1 cattle.

Notice that if the farmer's property rights guaranteed him compensation for any crop damage, the rancher would automatically be liable for any damage caused by his cattle and would still decide on ON_1 cattle. In this context the curve PP would denote the rancher's profit minus the financial liability for damage caused by different numbers of cattle. The maximum profit for the rancher occurs with ON_1 cattle, and this decision explicitly covers the external costs involved.

7.4.5 The type of remedy adopted to deal with externalities will depend on what is practicable in the given situation.

7.4.5.1 Property rights may be poorly defined and unclear. In such situations it may be impossible to define those individuals who should come together to negotiate an efficient solution.

> *Example. When a factory pours smoke into the atmosphere, at least the source of the external cost can be identified. But since no one has property rights to air, it is difficult to identify those individuals on whom the external cost is imposed.*

7.4.5.2 Irrespective of the definition of property rights, there may also be situations in which negotiation is extremely difficult because of the high transaction costs involved in bringing together all interested and affected parties, and the difficulty of getting information about preferences.

> *Example. When British Airways were seeking permission to land Concorde at Kennedy Airport, many groups of residents likely to be affected by the noise organized themselves to object to the proposals. But many other individuals, groups, and corporations were likely to be affected by the decision to allow Concorde to land in New York. In some cases external costs would be imposed (e.g. the possibility of increased noise level experienced by local residents). In other cases, external benefits would be received (e.g. a possible increase in demand for the goods of some companies, due to the larger number of visits made by overseas executives because of the much-reduced flight time). Some of these groups are easily identified, others much less so. And there would be enormous difficulty in actually arranging for all affected parties to gather together in order to agree on an efficient solution. Even if this were possible, obtaining information about individuals' exact preferences would be highly complex.*

MICRO UNIT 8

INCOME DISTRIBUTION

- 8.1 Marginal Productivity
- 8.2 Economic Rent
- 8.3 Monopsony
- 8.4 Trade Unions
- 8.5 Income Distribution, Collective Action and Economic Equity

8.1 Marginal Productivity

8.1.1 The demands for goods and services determine the demands for the factor inputs required to produce them.

Example. As the demand for automobiles has increased steadily throughout most of the century, the demands for factories, labor, steel, rubber, glass and other resources used in producing automobiles have grown apace.

8.1.2 The supplies of factors of production are determined by resources owners, i.e. they are the quantities of factor inputs resources owners are willing to supply at different prices.

Example. Ignoring immigration, the supply of labor in the U.S. is determined by people willing and able to work. One measure of labor supply is the number of man days the U.S. population is prepared to supply in a year and is determined by wage rates and other conditions of employment. In most countries during periods of war the labor supply increases.

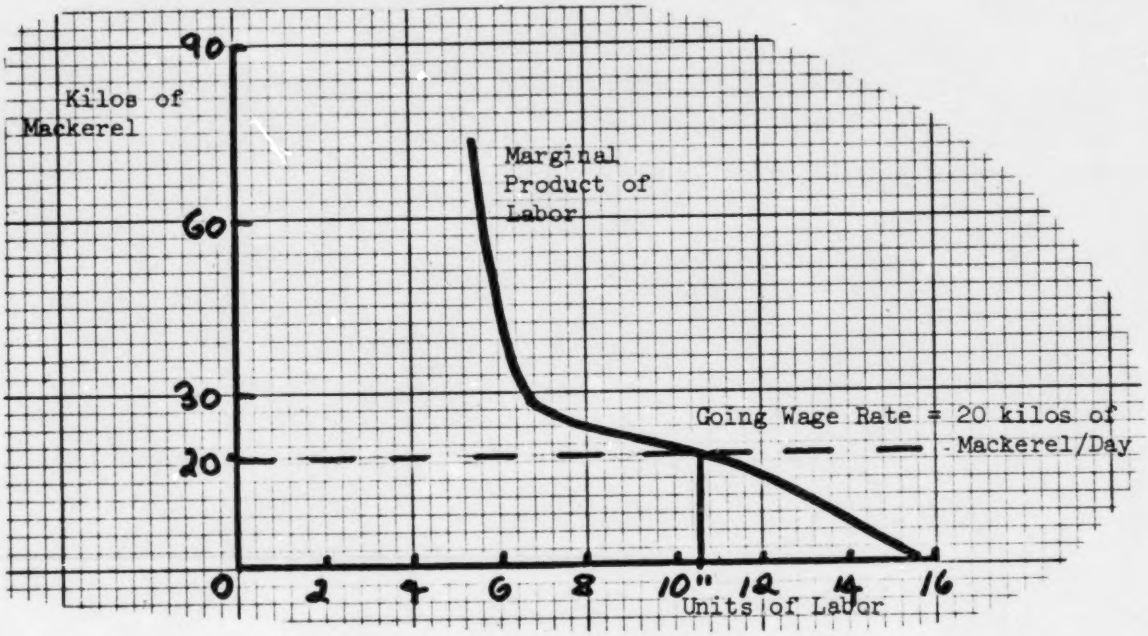
8.1.3 In a market the demand for a factor of production together with the supply of that factor determine the equilibrium price of the factor and equilibrium quantity exchanged.

Example. In the world tramp (cargo) shipping market the demand for new ships and the supplies of new ships determine the prices of new ships and the quantity built and sold. The demands for and supplies of second-hand vessels determine both the equilibrium prices and the quantities exchanged. Similarly, the demands for cargo space and the supplies of cargo space determine both freight rates and the amounts of cargo transported. The demands for seamen and the supply of seamen determine the wages of seamen and the number of men at sea.

8.1.4 A profit maximizing firm will hire a resource up to the point at which the marginal benefit of that resource equals its marginal cost. The marginal benefit of a resource is the contribution to output which would result from hiring one additional unit. The marginal cost of a resource is the price of an additional unit (3.4.8).

Example. Diagram 8.1.4(1) is a reproduction of part of Diagram 3.4.8(1).

Diagram 8.1.4(1): "Wage Rate" and Marginal Productivity Curve determine Number of Men Hired



By hiring up to 10 men the firm adds more to output than it does to cost for each additional man hired, i.e. MP > MC. The firm is indifferent about hiring an eleventh man because MP = MC = 20 kilos of mackerel. For each man hired after eleven are employed MC > MP.

8.1.5 The marginal productivity schedule of each factor of production for each firm is that firm's demand schedule for each factor.

Example. In Diagram 8.1.4(1) the firm's marginal product of labor schedule is the firm's demand schedule for labor. It relates the number of men the firm would hire at each wage rate.

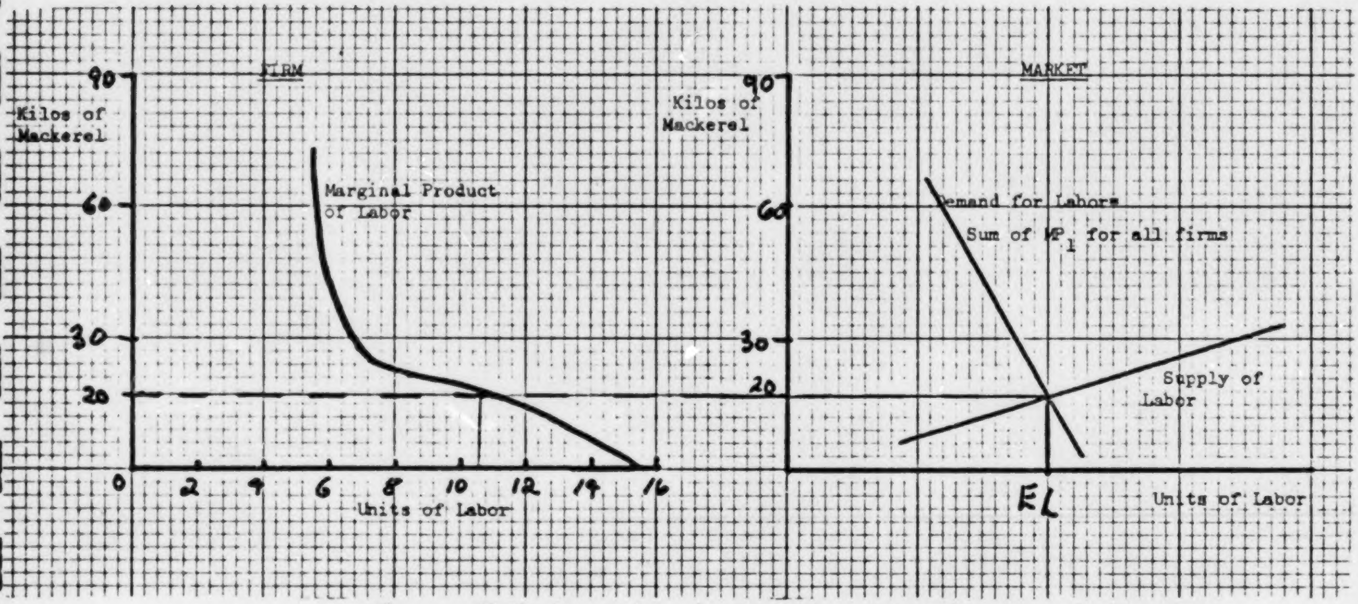
8.1.6 For any factor of production in a market the total demand schedule for that factor is the summation of the individual firm's demand schedules for that factor or the summation of the marginal productivity schedules of that factor.

Example. In the mackerel fishing market in which the firm represented in Diagram 8.1.4(1) is one firm, the market demand for labor is the summation of the marginal product of labor schedules of each firm in the market.

8.1.7 The equilibrium price and equilibrium quantity exchanged of a factor are determined simultaneously in a market by the intersection of the demand, the summation of the marginal productivity schedules, and the supply schedules. Each firm demanding a factor is a price taker as is each supplier of that factor.

Example. Diagram 8.1.7(1) shows the mackerel market for labor and the firm of Diagram 8.1.4(1).

Diagram 8.1.7(1): The Market for Labor



The equilibrium price is 20 kilos of mackerel and the equilibrium level of employment in the market is E_L. *All firms which wish to hire labor at 20 kilos per man day can do so and all individuals wishing employment at 20 kilos of mackerel per day can obtain employment. The withdrawal or addition of a firm and/or the withdrawal or addition of labor neither affects the wage rate nor the level of employment.*

8.1.8 The income a resource owner receives from the employment of his resource in a market will be determined by the amount of the resource he offers for employment and the going market rate for that resource.

Example. If a fisherman in the market depicted in Diagram 8.1.7(1) decides to work 7 days in succession he will receive 140 kilos of mackerel (20 x 7). If he decides to work 2 days only during a week he will receive 40 kilos of mackerel.

8.1.9 The greater the amount of resources owned by an individual and the higher the marginal productivity of each resource, the higher will be the income of a resource owner. Conversely, the smaller the amount of resources owned and the lower the marginal productivity of each resource, the lower will be the income received by that resource owner.

Example. Some individuals who own land and capital and have unique talents (labor) earn high incomes. Other individuals, for example the average slum dweller who owns no land, little capital and can only perform low skill tasks, earn a low income.

8.1.10 Resources can be bequeathed to an individual by nature, can be bequeathed to an individual by other individuals and can be acquired by an individual by employing resources.

Example. Some individuals are born with relatively unique talents such as a fine voice, athletic ability, high intelligence and beautiful/handsome features. Some individuals have resources thrust upon them by parents or other relatives, for example, property and part ownership of businesses in the form of stock. Most individuals acquire resources through training and/or education, for example, a student going through medical school is hiring resources to teach him medical skills.

8.2 Economic Rent

8.2.1 The difference between the value of the marginal product of a factor of production in its most productive use and its next best alternative employment is economic rent.

Example. If the value of the marginal product per annum of a football quarterback is $100,000, the contribution to the football club owning the player's contract of that quarterback is $100,000. If the quarterback's next best employment alternative to playing football is collecting garbage which pays $15,000 per annum, the economic rent of the quarterback is $85,000 ($100,000 - $15,000).

8.2.2 The allocation of economic rent between an employer and resource owner is determined by bargaining.

Example. In the example of 8.2.1 the quarterback is worth $100,000 to the football team which owns his contract. If the quarterback is indifferent between playing football and collecting garbage the minimum salary he would be prepared to accept to play football is $15,000, i.e. his opportunity cost. Thus the share of his economic rent of $85,000 which he collects will be determined by negotiation between himself and the owner of the football club.

8.2.3 In competitive factor markets economic rent does not exist since the value of the marginal product of a factor of production in its most productive use when employed by one firm will be the same as when employed by another competitive firm in the same market.

Example. If football players owned their own contracts and could leave one club and join another of their own volition, there would be no economic rent and each player would receive in income the value of his marginal product.

8.3 Monopsony

8.3.1 Monopsony, the oppositive of monopoly (6.3.1) one seller, occurs when only one employer of factor inputs exists in a market.

Example. In a "company town" where the company is the only major employer of labor, the company is a monopsonist.

8.3.2 The presence of monopsony in a factor market means lack of competition for the factors of production.

Example. In a "company town" the company does not have to compete with other firms for labor.

8.3.3 A firm operating in a competitive factor market faces a completely elastic supply for each factor, i.e. it can have as many units as it wishes at the going rate. A monopsonist, since it is the sole employer of factors faces the market supply schedule of each factor, i.e. positively inclined supply schedules. The number of units of each factor hired by the monopsonist determines the prices (rates) and the levels of employment.

Example. If the "company town" profit maximizing employer wishes to have more labor it will have to increase the wage rate to attract town people into employment or attract workers from other markets.

8.3.4 The cost to a monopsonist of hiring more units of a factor input, i.e. the marginal cost of that factor, equals the higher rate necessary to attract more of a factor plus the increase in rate to existing employed units of that factor, i.e. the marginal cost of a factor to a monopsonist exceeds the going rate.

Example. Suppose the only employer in town is in equilibrium in the labor market, i.e. his demand for labor, 50 men, equals the supply of labor, 50 men, at $2.00 per hour. Further suppose that he wishes to expand his activities and to do so he has to hire more labor. Suppose he has to increase the wage rate to $2.50 per hour to hire 1 more worker. The marginal cost of labor equals the $2.50 he has to pay to employ the 51st man plus $0.50 x 50 he has to pay existing employees, i.e. the marginal cost of labor when 50 men are employed is $27.50 which exceeds the wage rate.

8.3.5 A profit maximizing monopsonist will hire a factor of production up to the point at which benefit of hiring one additional unit of the factor (i.e. the value of the marginal product of the factor) is equal to the cost to the firm of hiring that factor (i.e. the marginal cost of the factor). The monopsonist will not hire a factor until the value of the marginal product equals the going rate for that factor since the marginal cost will exceed the going rate.

Example. The monopsonist in example 8.3.4 would only hire a fifty-first man if the value of the marginal product of labor equalled $27.50.

8.4 Trade Unions

8.4.1 The distinguishing economic feature of a trade union is that it represents a group of, or all resource owners in a market. In many markets employers negotiate rates and conditions of employment with union leaders.

Example. In the United States approximately 25% of labor is unionized. Some unions in trucking, construction and automotive industries represent the bulk of employees in these industries. In other industries such as agriculture the proportion of workers represented by unions is negligible.

8.4.2 If a union were to represent all resource owners in a market that union would have monopoly power, i.e. sole seller of a resource. Employers would have to deal with the union in hiring units of the resource unionized.

Example. In the U.S. General Motors, Ford and Chrysler have to negotiate wages and conditions of employment with the United Auto Workers Union. They are not free to hire labor as they wish.

8.4.3 If unions negotiate rates for a factor of production above the level which would have prevailed in a competitive factor market, profit maximizing employers will respond by equating the value of the marginal product of the factor to the negotiated rate. Given a downward sloping marginal product schedule for a factor of production, fewer units of the factor will be hired.

Example. In the 1930s John L. Lewis, a famous union leader of the coal miners in the United States, negotiated wage rates for coal miners which have been estimated to have been 100% higher than would have existed under competitive market conditions. It has been estimated also that the effect of such rates was to reduce drastically the number of jobs offered in the coal mines by the owners.

8.4.4 In the presence of monopsony in factor markets unions by negotiating a forced rate for a factor which is higher than the going rate can reduce the marginal cost of hiring additional units of a factor and can cause an increase in employment of that factor.

Example. If a union were to move into the company town of the example in 8.3.1 and fix a wage rate for labor above the going rate, the sole employer would face a horizontal supply curve of labor at that rate. The company could hire labor at that rate, i.e. the marginal cost of labor would equal that rate, until no more people were willing to work at that wage. The marginal cost of labor to the firm would equal the wage rate.

8.4.5 The debate over the effectiveness and desirability of unionization centers in the extent to which they decrease employment opportunities by artificially restricting the supply of factors of production to firms or alternatively make factor owners better off by eliminating monopsony power.

Example. Many people argue that trade unions, by forcing up wage rates, have caused unemployment in many sectors of the U.S. economy. The workers who remain employed have higher wage rates but such gains are at the expense of the unemployed and total output in the economy is reduced because such factors are idle. Others argue that unions by forcing up wages have not caused unemployment but have caused a redistribution of income from exploiting monopsonists to workers.

8.5 Income Distribution, Collective Action and Economic Equity

8.5.1 The more efficiently a society employs its resources the greater is the total output of goods and services and, by definition, the greater is society's total income.

> *Example. In recent years many resources in the U.S. have been unemployed or partially employed. It has been estimated that the difference between the value of the total goods and services produced in the U.S. and what could have been produced had all resources been fully employed has amounted to approximately $200b. per annum in certain years, i.e. total income accruing to the U.S. population has been $200b. per annum less than it could have been in those years.*

8.5.2 In determining how well off an individual or family is in an economy the distribution of total income must be considered as well as the size of the nation's income.

> *Example. In some mid-eastern oil producing economies the top 10% of income recipients receive approximately 90% of all income, i.e. total income divided by the population yields a misleading figure as to the well-being of the majority of families.*
>
> *In the U.S., where the average income level is one of the highest in the world, approximately 12% of the population is defined to be below the poverty line, i.e. earning insufficient income to adequately support life. At the other end of the spectrum the top 5% of income recipients earn almost 15% of the nation's income. The lowest 2% of income earners receive about the same amount.*

8.5.3 How efficiently an economy's resources are allocated and how evenly an economy's income is distributed are not related. An economy may be operating at maximum efficiency and have a very uneven income distribution. Conversely each individual in an economy could have the same income and the economy's resources could be very inefficiently allocated.

> *Example. Many people argue that the British government's policy of attempting to make incomes more equitable has had a serious impact on efficient resource allocation and cite the low growth in total income over the past two decades as evidence of inefficiency.*

8.5.4 A society may elect to alter the distribution of income caused through market forces for equity reasons.

> *Example. In most Western industrialized countries the governments representing the people enact legislation to provide income for the aged, the sick and the unemployed.*

8.5.5 Tax-transfer policies constitute a common method for income reallocation. Individuals with high incomes are taxed and individuals with low incomes receive transfers.

Example. The U.S. has a progressive income tax structure. As income levels increase over the population a larger proportion of the additional income is removed in the form of income taxes. Many individuals with zero income are supported completely by the government through transfer payments.

8.5.6 Taxes and payment in kind, i.e. goods and services, constitute another method of transferring income within a society.

Example. In the U.S. many poor families receive food stamps, subsidized housing, aid to dependent children, and free medical care paid for out of taxes.

8.5.7 Any program which redistributes income within a society causes some individuals, i.e. those taxed, to receive less than their contribution to total output, i.e. less than the value of their marginal products. The recipients of transfers in cash or kind receive incomes in excess of their contribution to total output, i.e. in excess of the values of their marginal products.

Example. When Muhammad Ali earns $10m. from a championship fight it means that society by the fact of being prepared to pay that sum to see him fight values his services in a fight at $10m., i.e. $10m. is the value of his marginal product. The U.S. government taxes Ali a significant portion of his $10m., some of which is received by the poor in the form of cash or kind.

8.5.8 Out of a given national income any redistribution scheme, by definition, can only make one group in society better off by making some other group worse off.

Example. If the U.S. were to decide tomorrow that out of the existing national income no family would have less than $6,000 this year, some groups' existing incomes would have to be reduced to make this redistribution possible.

8.5.9 How a society's income should be distributed is a question of value judgment and is not subject to economic analysis. Economic analysis can be used to assess the impact of any tax-transfer policy in an economy but cannot be used to determine the 'correct' income distribution.

Example. The most conservative business men and the most radical students have their own opinions on how incomes should be distributed in the U.S. Such opinions are value judgments and each person is as well qualified to give his opinion as is anyone else. An economist, in his professional capacity, cannot state that one opinion is superior to another, though he could offer advice on the most efficient way to achieve any given income distribution.

MICRO UNIT 9

INTERNATIONAL TRADE

9.1 Gains from Exchange

9.2 Theory of Comparative Advantage

9.3 Tariffs and Quotas

9.4 Exchange Rates

9.1 Gains from Exchange

9.1.1 When two individuals voluntarily take part in exchange, both individuals benefit. An individual can increase total utility by exchanging some of a good for which his marginal utility is relatively low for some of a good for which his marginal utility is relatively high (4.2.2), i.e. different marginal utilities encourage exchange.

> *Example. Both sellers and buyers of Tom Watson Golf Clubs benefit from exchange. Those individuals who buy these clubs gain more utility from the clubs than from the money required to buy them. Similarly, sellers of the clubs gain more utility from the money they receive from the sale of the clubs than from the clubs themselves.*

9.1.2 Gains from exchange exist whether trade takes place between individuals within a given country or between individuals in different countries.

> *Example. If Japanese buyers of U.S.-produced Tom Watson Golf Clubs and U.S. sellers of the clubs find trade mutually advantageous, there will be an incentive for trade to take place internationally, and both buyers and sellers will benefit from the exchange.*

9.1.3 International trade in goods and services makes possible higher living standards in trading nations without an increase in the amount of goods and services produced because of differences in relative marginal utilities.

> *Example. The United States exports electronic equipment to Brazil and imports coffee from Brazil. Through the exchange U.S. citizens and Brazilian citizens enjoy higher living standards than they would if the electronic equipment remained in the U.S. and coffee remained in Brazil.*

9.1.4 In any time period with given amounts of goods and services in each nation the incentive to trade will cease when relative marginal utilities are equal in each nation.

> *Example. In the example in 9.1.3 in any given time period assuming free trade between Brazil and U.S.A., a point will be reached when any further exchange of coffee for electronic equipment would make both nations worse off.*

9.1.5 An environment in which exchange is possible motivates resource owners to specialize in the production of goods and services which they can produce relatively more efficiently than other resource owners and exchange these goods and services for goods and services produced relatively more efficiently by other resource owners, i.e. different marginal cost of goods and services encourages specialization and exchange.

Example. By allocating sufficient resources to create ideal growing conditions Northern Canada could produce citrus fruit. Similarly California could grow conifers. Both Canadians and Californians are better off by allocating their resources to those goods they can produce relatively more efficiently and trading with each other.

9.1.6 Limits to specialization are the extent of the market and changing marginal costs with increased production. These factors plus transportation costs limit exchange.

Example. If factor inputs were homogeneous in Brazil one could imagine Brazil supplying the world's coffee wants. However, only certain areas of Brazil are ideally suited for coffee growing and in these areas coffee is produced with minimum resources. To expand coffee output Brazil has to use additional resources per unit of output with a concomitant rise in unit costs. As these costs have risen other areas in the world, e.g. Uganda, can produce coffee in competition with Brazil. By addition of transportation costs Uganda coffee is cheaper in neighbouring countries than is Brazilian coffee.

9.2 Theory of Comparative Advantage

9.2.1 The theory of comparative advantage shows how nations benefit from trading when differences exist in the relative marginal costs of goods and services.

Example. Imagine a two good (clothes and food) two country (country A and country B) world, in which the marginal costs are those shown in Table 9.2.1(1).

Table 9.2.1(1): Marginal Costs of Food and Clothing

	Cost of 1 suit of clothes	Cost of 1 basket of food
Country A	8	4
Country B	6	2

In country A the cost of an additional suit of clothes is twice the cost of an additional basket of food.

In country B the cost of an additonal suit of clothes is three times the cost of an additional basket of food.

Assuming all resources in both countries are allocated efficiently to the production of food and clothes, the production of 1 additional suit of clothes in country A means reducing output of food by 2 baskets. Similarly the production of 1 additional suit of clothes in country B means reducing output of food by 3 baskets.

Suppose country B offered country A 2½ baskets of food for 1 suit of clothes. Country A, by reallocating resources at the margin, could reduce production of food by 2 baskets, increase production of clothes by 1 suit and trade the suit for 2½ baskets of food. Country A clearly would benefit because the output of clothes would be unaltered but an additional ½ basket of food would be available for consumption.

Country B by reducing output of clothes by one suit can produce an additional 3 baskets of food. By trading 2½ baskets for 1 suit of clothes, the amount of clothes available in country B remains unaltered but an additional ½ basket of food is now available in country B for consumption. Clearly country B benefits from the exchange.

9.2.2 Nations can benefit from trade even if one nation has an absolute advantage in the production of all goods and services compared to other nations, i.e. lower marginal costs of all goods and services.

Example. In Table 9.2.1(1) country B has an absolute advantage over country A in the production of both clothes and food, i.e. lower marginal costs, but as shown in example 9.2.1 trade is beneficial to both countries because of the difference in relative marginal costs.

9.2.3 Differences in marginal costs occur in different regions within a country and between countries. These differences are attributable to many factors.

Example. The marginal cost of tomatoes is much higher in New York than in California and much cheaper in Mexico than in the United States. The differences are attributable to climate, factor input prices, efficiency and attitudes of labor, etc.

9.3 Tariffs and Quotas

9.3.1 One non-economic factor limiting the extent of trade between countries is tariffs. A tariff is a tax on an imported good which anyone buying the good will have to pay in addition to the selling price of the good.

> *Example. Anyone in the United States buying a foreign automobile, e.g. Volkswagen, Toyota, Mercedes, has to pay not only the price of the automobile but also a tariff to the U.S. government.*

9.3.2 A second non-economic factor limiting the extent of trade between nations is quotas. A quota limits the amount of a good which can be imported to a country.

> *Example. The U.S. government has established a quota on the number of suits which may enter the United States from Hong Kong, for example. When the quota is filled, Hong Kong suit producers are not permitted to export additional suits to the United States at any price.*

9.3.3 Tariffs and quotas are imposed by countries because, despite the fact that the greater the amount of trade the better off, on average, people in trading countries will be, trade can make some people worse off.

> *Example. If tariffs were removed from all foreign automobiles the prices of imported cars would be lower and the quantities purchased higher. Fewer U.S. automobiles would be purchased and resources owners in the U.S. automobile industry would experience lower returns. Resources would move out of the industry and until equilibrium was re-established lower incomes would result.*

9.3.4 Domestic resource owners who would become worse off by imports of the types of goods in which their resources are employed have an incentive to have tariffs and quotas imposed on these goods for personal not societal well-being.

> *Example. While the importation of Japanese textiles to the U.S. can make the U.S. citizens on average better off by the purchase of cheaper Japanese textiles, displaced domestic textile workers and resource owners in U.S. textiles can become worse off as employment and output are reduced in the U.S. textile industry.*

9.3.5 In market economies resources owners adversely affected by imports are often more vociferous in advocating tariffs than are consumers advocating free trade.

Example. The U.S. government has been sympathetic to the pleas of textile workers arguing for protection from cheap foreign imports. Seldom does the general public lobby for cheap Japanese underwear. Political lobbying has been responsible for most of the tariffs and quotas currently in existence in the U.S.

9.4 Exchange Rates

9.4.1 International trade is conducted through a system of exchange rates which determine the relative value of different currencies.

Example. As shown in 9.2.6, in order to enable U.S. consumers to buy cloth from Japan, and Japanese consumers to buy wheat from the U.S., it is necessary to know the rate at which the dollar exchanges for the yen.

9.4.2 The market in which individuals buy and sell the currencies of different countries is called the foreign exchange market.

Example. If a U.S. consumer wished to buy cloth from Japan, he would need to purchase the required number of yen to finance his purchase. Simultaneously, he will sell the appropriate number of dollars in the foreign exchange market to obtain Japanese currency.

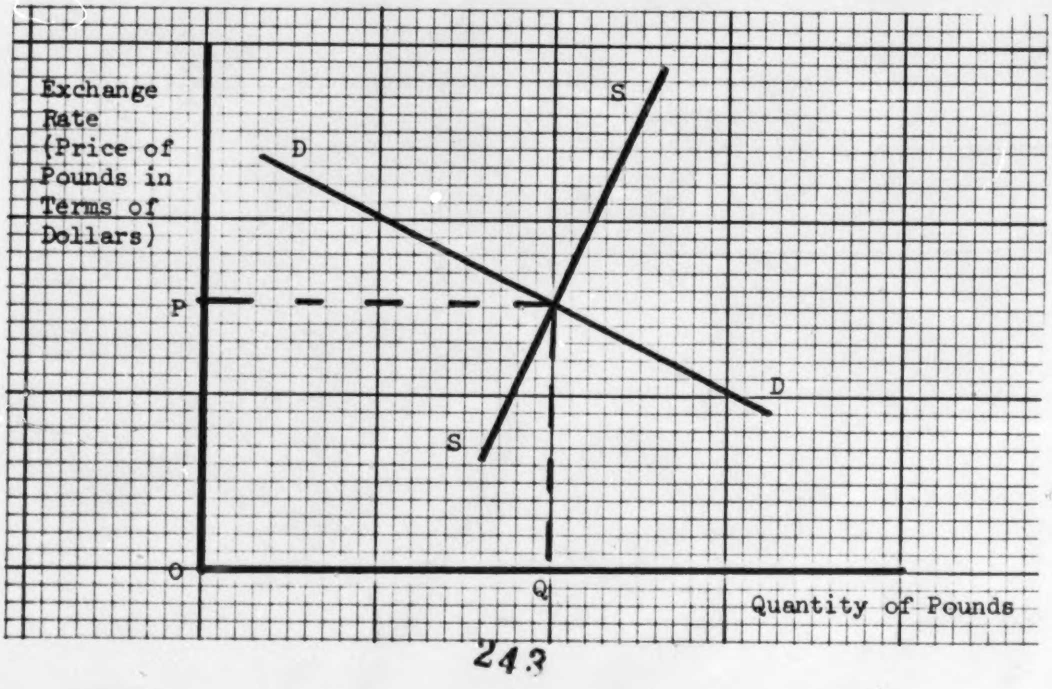
9.4.3 The foreign exchange market, like other markets, is subject to the forces of demand and supply.

Example. There will be a demand for U.K. pounds sterling (£) by U.S. individuals who wish to purchase goods and services produced in the U.K. Similarly the supply of U.K. pounds for U.S. dollars will depend upon U.K. consumers' desires to purchase U.S. goods and services.

9.4.4 The exchange rate between two currencies will be determined by the intersection of the demand for and the supply of the currencies.

Example. The supply and demand curves for pounds are illustrated in Diagram 9.4.4(1).

Diagram 9.4.4(1): The Supply and Demand for Pounds



The exchange rate between the pound and the dollar is set at the level where the supply curve and the demand curve intersect, i.e. at point E. Given these supply and demand curves, the exchange rate, i.e. the price of pounds in terms of dollars, will be OP and the quantity of pounds bought and sold will be OQ.

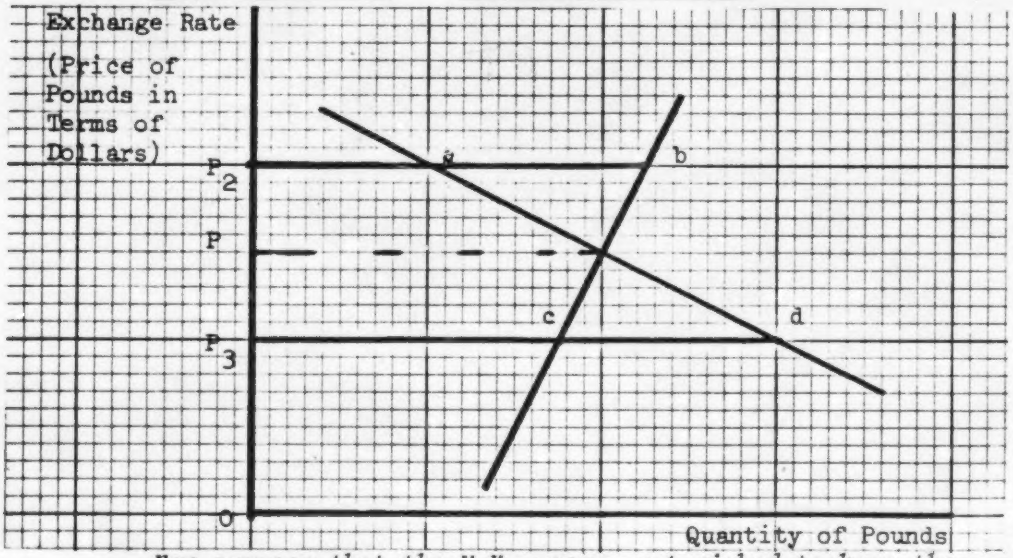
9.4.5 **When exchange rates between currencies are set by the forces of competitive exchange markets a system of flexible exchange rates is said to exist.**

Example. Suppose that U.S. consumers wished to buy more pounds to finance increased spending on British goods and services. The demand curve for pounds would thus shift to the right, leading to a higher exchange rate between the currencies and a higher quantity exchanged. British goods would become relatively more expensive to U.S. buyers since they would have to give up more dollars to obtain British pounds. Conversely, U.S. goods would become relatively cheaper to British citizens because they would receive more dollars for each pound.

9.4.6 **If governments decide to fix the exchange rate of currencies at a certain level, a system of fixed exchange rates is said to exist.**

Example. Suppose that the equilibrium exchange rate of pounds for dollars was OP as shown in Diagram 9.4.6(1).

Diagram 9.4.6(1): Fixed Exchange Rates



Now suppose that the U.K. government wished to keep the exchange rate at OP_2 instead of OP. At the rate of OP_2 the quantity of pounds supplied exceeds the quantity demanded. In order to prevent the exchange rate from falling, the U.K. government would have to buy ab pounds and pay for them with dollars.

Alternatively, suppose that the U.K. government wished to fix the exchange rate at OP_3 *at which the quantity of pounds demanded exceeds the quantity supplied. In order to prevent market forces leading to a rise in the exchange rate, the U.K. government would have to sell cd pounds in exchange for dollars.*

9.4.7 Under a system of fixed exchange rate a government can always obtain sufficient of its own currency to satisfy excess international demand for it by borrowing and/or by domestic taxation. The limit to eliminating excess supply of its currency at a fixed exchange rate is the reserves of other currencies owned by the government and/or its borrowing potential abroad.

Example. Recently the U.S. government has supported the falling dollar by buying dollars in foreign markets with pounds, marks, yen and other currencies owned by the U.S. monetary authorities. In contrast, for many years under a fixed exchange system the British government borrowed money from abroad to support the pound and persuaded other nations to buy pounds to eliminate excess supply.